VOLUME XIII June, 1925 NUMBER 6

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[FOUNDED IN 1906 AS THE AMERICAN QUARTERLY OF ROENTGENOLOGY]

THE AMERICAN JOURNAL OF ROENTGENOLOGY AND RADIUM THERAPY

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BY PAUL B. HOEBER, INC., 67-69 EAST 59TH STREET, NEW YORK CITY

AMERICAN ROENTGEN RAY SOCIETY MEETINGS

Twenty-Sixth Annual Meeting
WASHINGTON, D. C.—SEPTEMBER, 22, 23, 24 AND 25, 1925
CENTRAL SECTION—*Seventh Annual Meeting*
CHICAGO, ILLINOIS

Entered as second-class matter, March 3, 1916, at the Post Office, New York, N. Y., under the Act of March 3, 1879.
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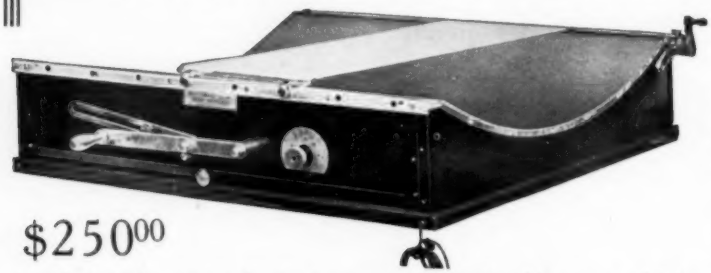

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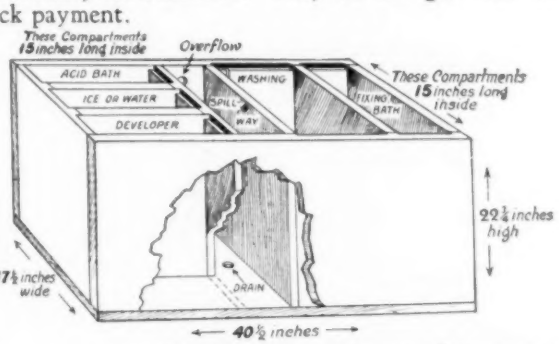

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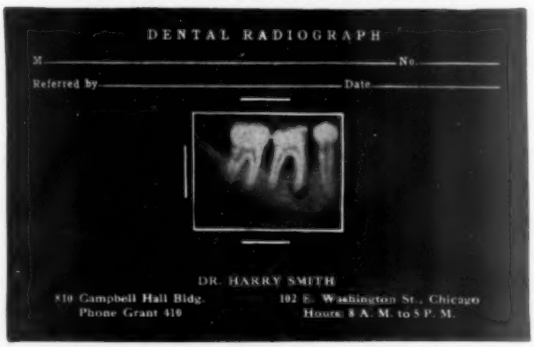

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THE AMERICAN JOURNAL OF ROENTGENOLOGY AND RADIUM THERAPY

VOL. XIII JUNE, 1925 No. 6

CHOLECYSTOGRAPHY, AFTER THE METHOD OF GRAHAM, COLE AND COPHER*

BY SHERWOOD MOORE, M.D.

From the Medical School of Washington University

ST. LOUIS, MISSOURI

CHOLECYSTOGRAPHY after the method of Graham, Cole and Copher consists in the visualization of the gall-bladder rendered opaque to the passage of roentgen rays by substances excreted into it in the bile. For the details of this work reference is to be had to the publications of those authors. It is only necessary here to describe the methods used, doses given and the roentgenologic technique.

Several dyes have been employed, the most uniformly satisfactory being the sodium salt of tetrabromphenolphthalein. In the beginning of this work tetraoidophenolphthalein was tried but the preparations then available were for some reason unstable and hence gave uncertain results. Later preparations have been free from this objection and they have been used latterly in several cases. The cholecystograms with this salt have seemed to be of better quality than those of the tetrabromphenolphthalein salt, and there is a further advantage that a lesser quantity needs to be injected and hence there would be less toxicity (Fig. 1).

The dye, in our hands, has been successfully given only by the intravenous method, though it has been administered by mouth and by rectum. By the former, either through vomiting or diarrhea, failure has been the result. Though gall-bladder shadows were obtained by the rectal injection they have not been satisfactory because of early expulsion of the injection. A suspension of the salt in oil has been used for subcutaneous administration in animals but has not proved practical.

The dose of salt given is, in the case of tetrabromphenolphthalein, 4.5–5 gm. for patients weighing above 120 pounds and somewhat less in lighter subjects. The tetraiodophenolphthalein salt is satisfactory in 3-gm. doses. As there are many things that can vitiate the result in cholecystography the directions as laid down by Graham, Cole and Copher[1] are quoted in full and should be followed exactly.

"Technique. Injection of the sodium salt is very easily done with a syringe; preferably in two doses one-half hour apart. We have not given it all in one dose and do not know if any deleterious results would follow. Much better results are obtained if the injection is made in the morning between 7:30 and 9:30 A.M., before breakfast.

"If Mallinckrodt's crystalline sodium salt is used, the solution is prepared by adding about 40 c.c. distilled water to 5½ grams of the sodium salt. It is ready for injection after filtration and sterilization. If the patient weighs less than 120 pounds, the dose should be reduced accordingly; great care must be exercised not to allow extravasation of the solution into the tissues of the arm. To avoid this possibility the needle should be first inserted into the vein before the syringe containing the material is attached. After completing the injection, it is well to run a little saline solution through the needle.

"Orders for the patient:

1. Omit breakfast.
2. Omit lunch (may have glass of milk).
3. Lie on right side of abdomen or be up walking around.
4. Omit proteins from evening meal.
5. May have water by mouth.
6. Sodium bicarbonate, grs. XL, every three hours for 48 hours.

"Roentgenograms are taken at 4, 8, 24 and 32 hours."

* Read at the Sixth Annual Meeting, Central Section, AMERICAN ROENTGEN RAY SOCIETY, Detroit, Mich., Feb. 19–21, 1925.

As far as roentgenographic technique is concerned, any method that will produce good roentgenograms of the gall-bladder region will be adequate.

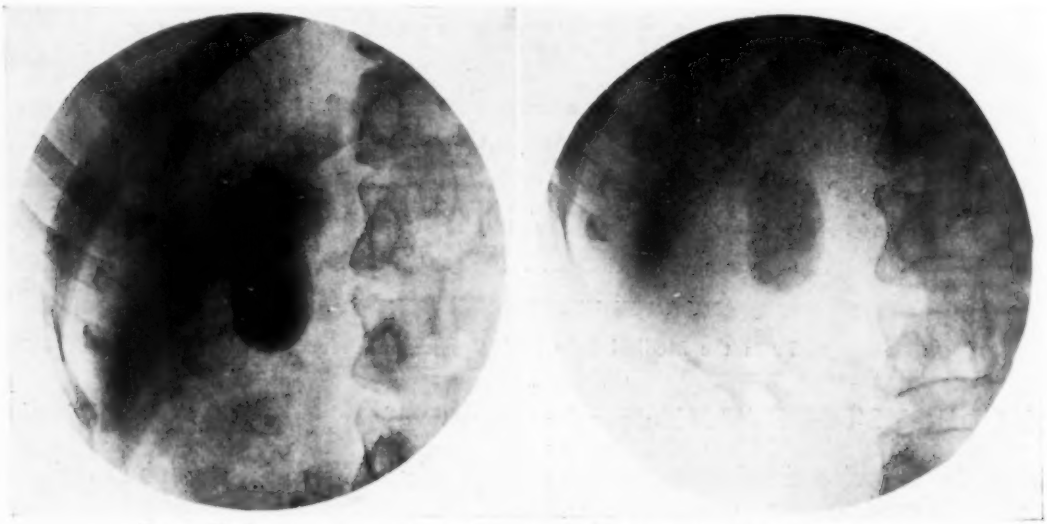

FIG. 1. Cholecystograms with tetraiodophenolphthalein. Note intensity of shadow.

Before the development of cholecystography, roentgenographic examination of the gall-bladder consisted in the demonstration, in the order of their importance, of stones, a thickened gall-bladder and a few unreliable secondary signs of cholecystic disease (Figs. 2 and 3). When clearly elicited, any one or all of these are of the greatest value in arriving at a correct conclusion in regard to the existence of disease in the biliary tract. Unfortunately, these findings are, at best, difficult to elicit, allow of uncertainty and difference of opinion in interpretation, and, most serious drawback of all, they are not inevitable concomitants of disease of the gall-bladder. They may be, and frequently are, entirely lacking in extreme cholecystic disease, even of chronic nature. Their existence is probably always sequential

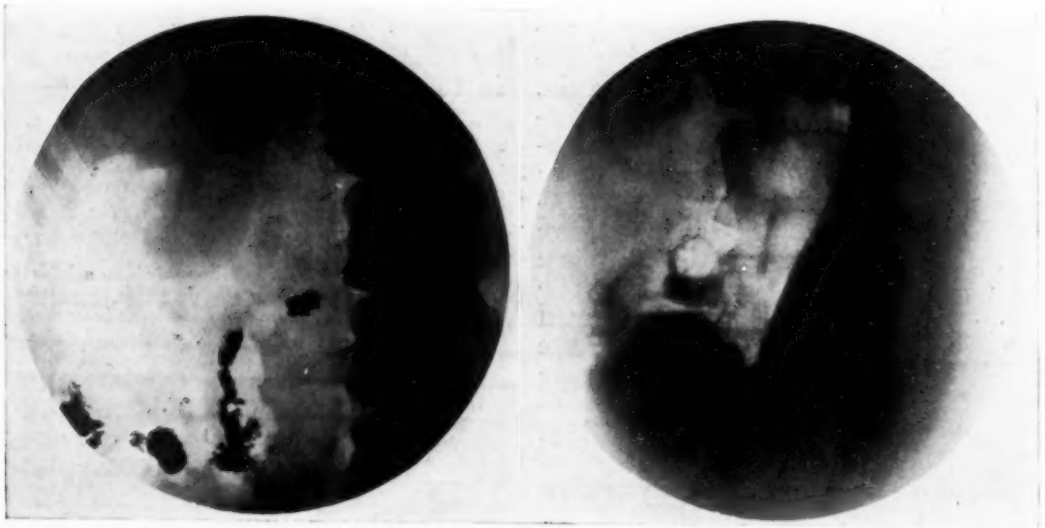

FIG. 2. Normal individual. Shown to illustrate unreliability of antral impression as sign of cholecystic disease. On left, normal cholecystogram; on right, impression of same on barium filled stomach.

to long-standing or repeated attacks of gall-bladder disease and never of its acute phases. In short, these roentgenographic signs are but the resultants of affections of the gall-bladder and, though when obtained may be relied on, they are only inferential in nature.

In the past eight years in the roentgen department of Washington University School of Medicine there have been 85 reports of gall-stones, only 33 of which have been operated on, and of this number 32 were found to have stones—a percentage of 97 correct for positive report of stones. Over this same period there were 42 examples of negative reports of gall-stones in which stones were found at operation and 30 cases operated on in which stones were found neither on roentgen examination nor operation but there existed a pathological gall-bladder. In the roentgen department but little weight has been given to the diagnostic value of a demonstrable gall-bladder outline or the secondary signs of gall-bladder disease. In consequence only 7 such cases are included in the foregoing figures. Enough has been said about the most reliable roentgenographic indication of a pathological gall-bladder, namely, stones, to indicate that their demonstration is a most uncertain method of estimating disease of that organ. The other signs are far more so.

Taken with the known high incidence of disease of the gall-bladder, this uncertainty of result of roentgen examination makes most welcome to the roentgen worker a more accurate method of study of the biliary tract. The unreliability of the roentgen examination of the gall-bladder has been so great that, in spite of the excellent work of men like Cole, George, Mills, Kirklin, Arens and others, many clinicians and some roentgenologists discredit it entirely. Cholecystography, as far as it has been used in our laboratory, seems to bridge the gap left by the older method of examination and supplies a much more precise knowledge of the diseased gall-bladder. Our roentgenologic diagnosis based on the demonstration of stones, a thickened gall-bladder and the secondary signs of a pathological gall-bladder is 34.7 per cent correct.

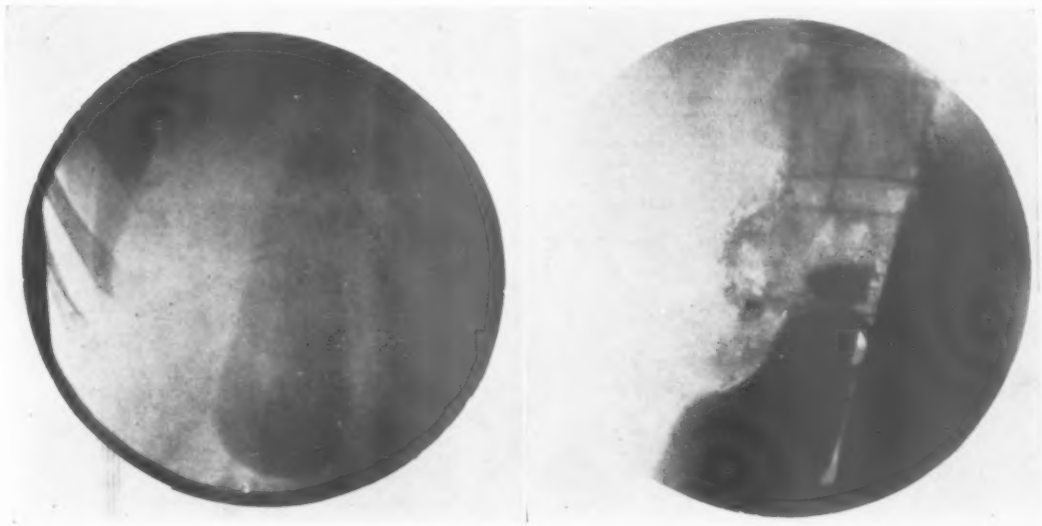

FIG. 3. Same as Figure 2.

Although cholecystography promises so much, there are no indications that it will supplant present methods of roentgen examination in this field. Instead of simplifying procedures it has complicated them by introducing another step that has to be used if the best type of work is to be done. This added complexity is, however, offset by the value of the findings so brought out.

I do not believe that the patient with symptoms of gall-bladder disease should

have the investigation of the alimentary tract with the opaque meal omitted, save in exceptional circumstances. Since the signs of disease of the structures of the right upper abdominal quadrant are so often not clear, the best results will come from a roentgen examination of the gall-bladder and a gastrointestinal examination, to be followed by cholecystography.

To date there have been 156 cases on which cholecystography has been done. Of these, 58 were on individuals presumably normal so far as the gall-bladder was concerned. Ninety-eight had suggestive signs or symptoms of gall-bladder disease and 53 were operated on, the operative findings to be referred to later. There were 9 failures in the procedure, of which 8 were roentgenographic technical failures. With time and patience applied, technical failures should be wholly, or at least very largely, eliminated.

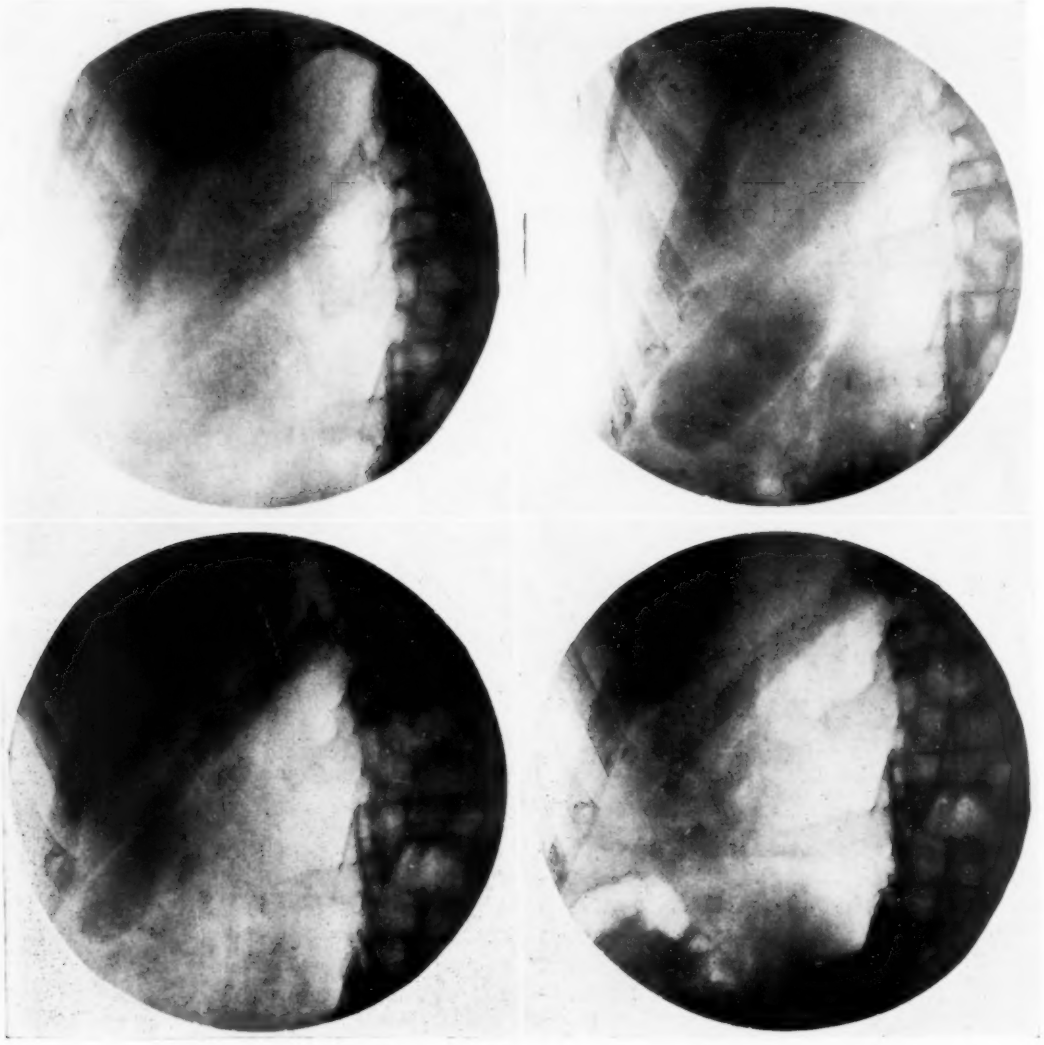

FIG. 4. Normal cholecystogram with tetrabromphenolphthalein. Above, at left, 4 hours; at right, 8 hours. Below, at left, 24 hours; at right, 30 hours.

The behavior of the normal gall-bladder has been perfectly described by Graham, Cole and Copher.[2]

"A normal gall-bladder will begin to cast a shadow from three and one-half to five hours after the injection; will show a tendency to change in size; will cast its

heaviest shadow between sixteen and twenty-four hours (Fig. 4) and empty in about forty-eight hours. The shadow shown on the four- and eight-hour plate is almost invariably larger than the subsequent shadows."

To this can be added a fairly wide range of normal variation in position, size, shape and relation to other structures where visualized (Fig. 6). There are some few cases that indicate that the observation of Mills[3] on the relationship of bodily habitus to the form, function and tonus of the alimentary canal applies with equal force to the gall-bladder, now that there are the means of visualizing it. Bearing that work in mind, it does not seem too rash to predict that seeming anatomical variations of the gall-bladder will be explicable on the basis of the individual's habitus. Drawing the parallel with the other abdominal viscera, and I believe it can be done, each type of habitus should have a characteristic gall-bladder. For example, the asthenic should show a long, laterally narrow gall-bladder in a low position (Fig. 7) in the abdomen, whereas the sthenic individual should show a shorter, wider, in fact circular shadow close up under the costal margin. The intermediate types

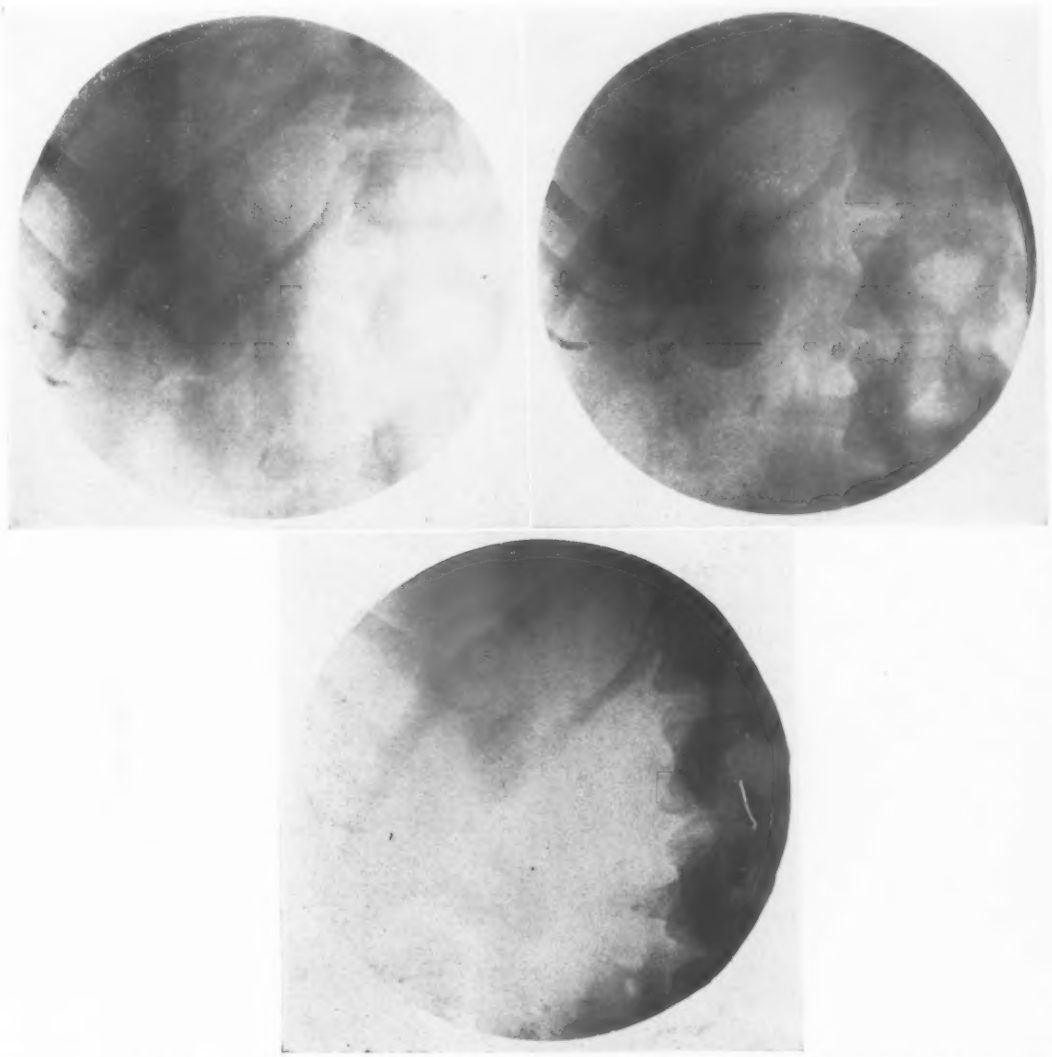

FIG. 5. Normal cholecystogram with tetrabromphenolphthalein. Above, at left, 4 hours; at right, 8 hours. Below, 24 hours. Note large and intense shadow at 8 hours.

should give intermediate forms, sizes and positions. The asthenics should have, because of their generally slower motility, a slower rate of emptying, if it is true that the gall-bladder empties itself, and hence, a shadow persisting beyond that of the meal in the stomach and the varying forms of this organ that were considered pathological and which we now know are normal for the given individual, it is urgent that similar confusion should not arise in regard to the gall-bladder, especially since it

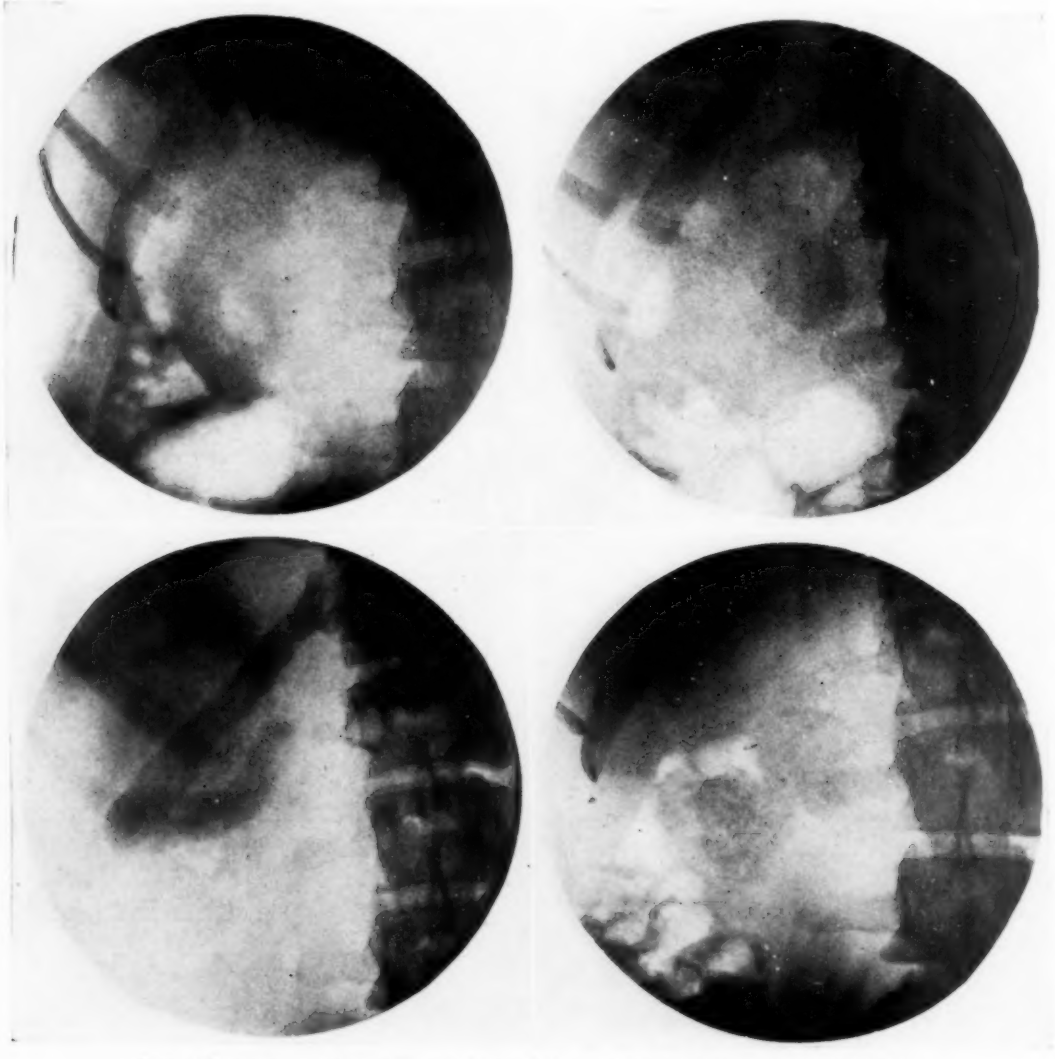

FIG. 6. Same as preceding (Fig. 5). Note shift of position of shadow of gall-bladder.

sthenic. There are no data on which to draw a parallel on the filling of the gall-bladder in the various types. I have been led into this speculation with a very meagre foundation of fact on which to rest it, but the subject is so important that it seems to call for the play of imagination. Furthermore, recalling the confusion of the early work with the use of the opaque might result in the subjection of the patient to an uncalled-for operation.

Since it has been claimed that a given habitus should have a characteristic position and shape of gall-bladder shadow, it follows that if it does not there is strong evidence of its being affected by disease. A sthenic with a gall-bladder at the pelvic brim, if this can be conceived, has his

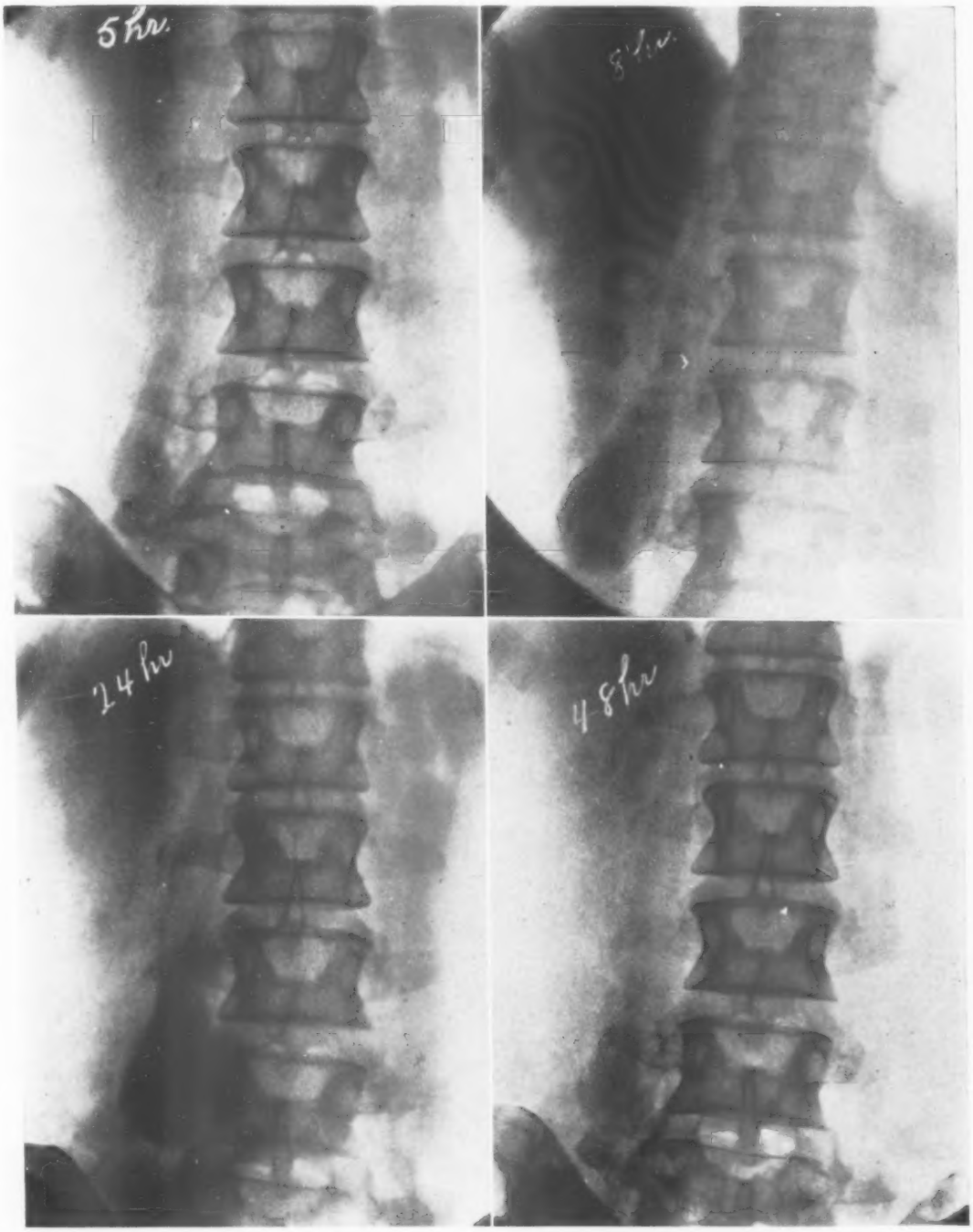

FIG. 7. Cholecystogram. Reproduced through kindness of Dr. E. A. Merritt, of Washington, D. C. Unconfirmed, but considered normal.

gall-bladder in that position through disease. Actual disease in the biliary tract, as far as our work has gone, results in deficiency or absence of shadow of the gall-bladder, and hence in such cases the influence of habitus on the gall-bladder findings is not of much importance. As there is small likelihood that intrinsic disease of the organ would produce changes disharmonious with the habitus, such changes must result from extracystic causes. On the other hand, functional disturbance, of which we know little, when investigated by this means must

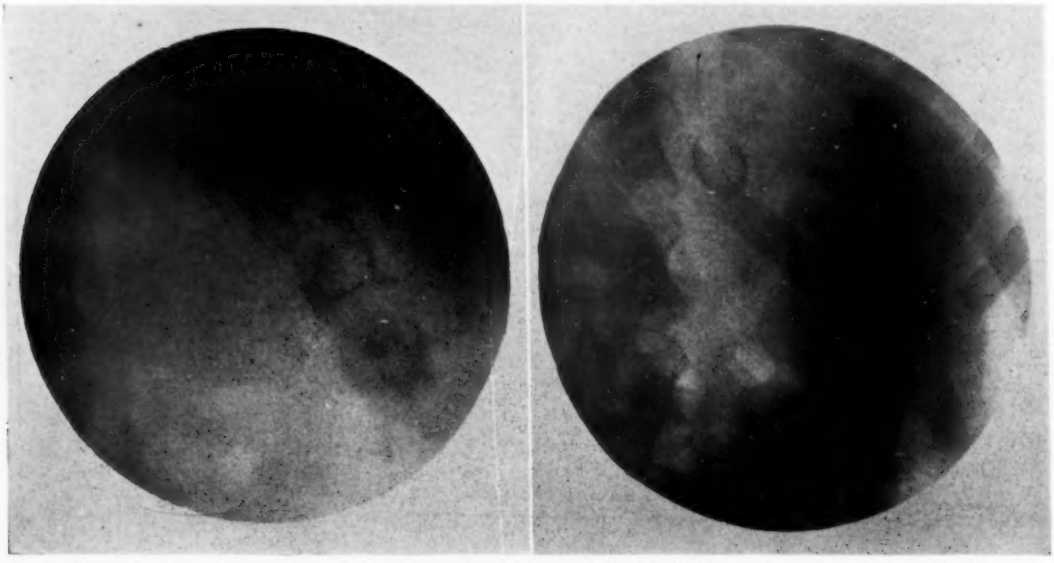

FIG. 8. Example of gallstones found before tetrabromphenolphthalein injection in which none of the dye reached the gall-bladder.

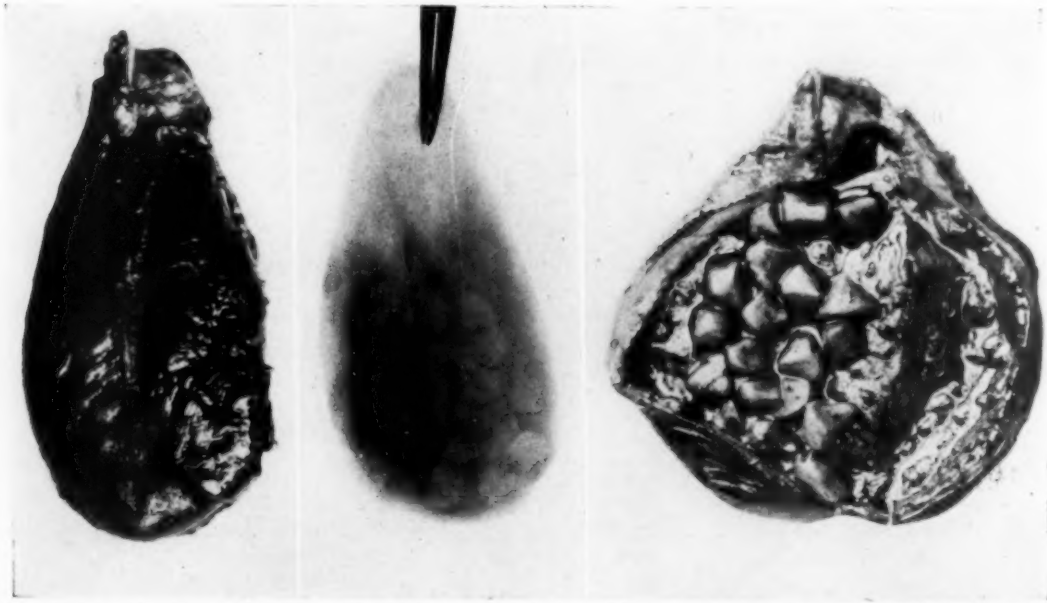

FIG. 9. Example of gall-bladder that will cast no shadow. Photograph, roentgenogram and photograph of opened, excised gall-bladder. Type of stone which can hardly be found on roentgen examination, the specific gravity being that of bile.

have due weight given to the part played by the physical make-up of the patient as a determinant of the form and position of the gall-bladder.

In order that the gall-bladder may be visualized it is necessary, as has been pointed out by Graham, Cole and Copher,[4] (1) that the liver excrete the dye; (2) that the hepatic, cystic and common ducts be patent; (3) that the gall-bladder have the ability of emptying and filling itself; (4) that the latter, once filled, be of a size to contain a sufficient amount of dye to give rise to a shadow; and (5) that the gall-bladder be able to concentrate the dye.

The first condition, because of the overload capacity of the liver, will probably always be met, except in extreme hepatic disease, where there would be no occasion to employ the dye. Several of the cases of this series had a hepatitis. It is obvious that occlusion of the hepatic and cystic ducts prevents the ingress of the dye into the gall-bladder. The fact, and our observations establish it, that a block of the common duct prevents concentration of the dye in the gall-bladder is rather difficult to understand unless on the ground that the overfilled gall-bladder has lost its power to take out fluid from the bile and the lack of diffusion of the dye in the arrested bile. Some cases of common duct obstruction seem to show a concentration of dye in the liver. No shadow was shown in a case of tumor of the kidney, believed to be result of pressure on the duct. A gall-bladder filled with stones, inspissated bile or other contents which it cannot discharge, whether through their properties or its own insufficiency, cannot be demonstrated (Figs. 8 and 9).

If through disease and subsequent contracture of the organ its capacity is too far reduced, not enough dye can be contained to give a shadow. The gall-bladder must be able to concentrate the bile and intensify the shadow.

If these conditions are fulfilled a cholecystogram should be produced such as described by Graham et al., quoted above. Failure to obtain such a shadow has, in the series worked out, indicated disease in the biliary tract which has had operative confirmation in 44 cases. Our proved pathological cases have presented no shadow or show lack of intensity with constancy of size. Gradations in intensity should be appraised with care, especially those that border on the density approximating that of the normal shadow. The light intensities are fairly safe ground on which to base conclusions; the heavier, less so.

The 44 pathological cases operated on had, with 5 exceptions, definite history indicative of gall-bladder disease of fairly long duration and this was confirmed by the pathological examination. Five cases with no history of disease of the biliary tract and with normal cholecystograms had the gall-bladder and the ducts examined in the course of a laparotomy and they were found normal. Two cases were operated on because we considered that the cholecystograms deviated from the normal. One was interpreted as being deformed by adhesions and at operation these were not found (Fig. 10). It was one of the early cases and gave such a good shadow that with our present knowledge we would consider it normal. The other had a faint shadow and was therefore considered pathological, but on inspection and palpation at operation seemed normal. I do not consider that this last should be charged as an error

FIG. 10. An early case thought pathological because of shape. Normal at operation. Shadow of this intensity we always consider normal.

since the organ was not removed and opened. Of the 53 cases operated, then, 5 were interpreted as normal and found to be so at operation; 2, normal at operation, gave no shadow;* 46 were believed to be pathological and 44 were positively confirmed, giving a percentage of 92.5 correct.

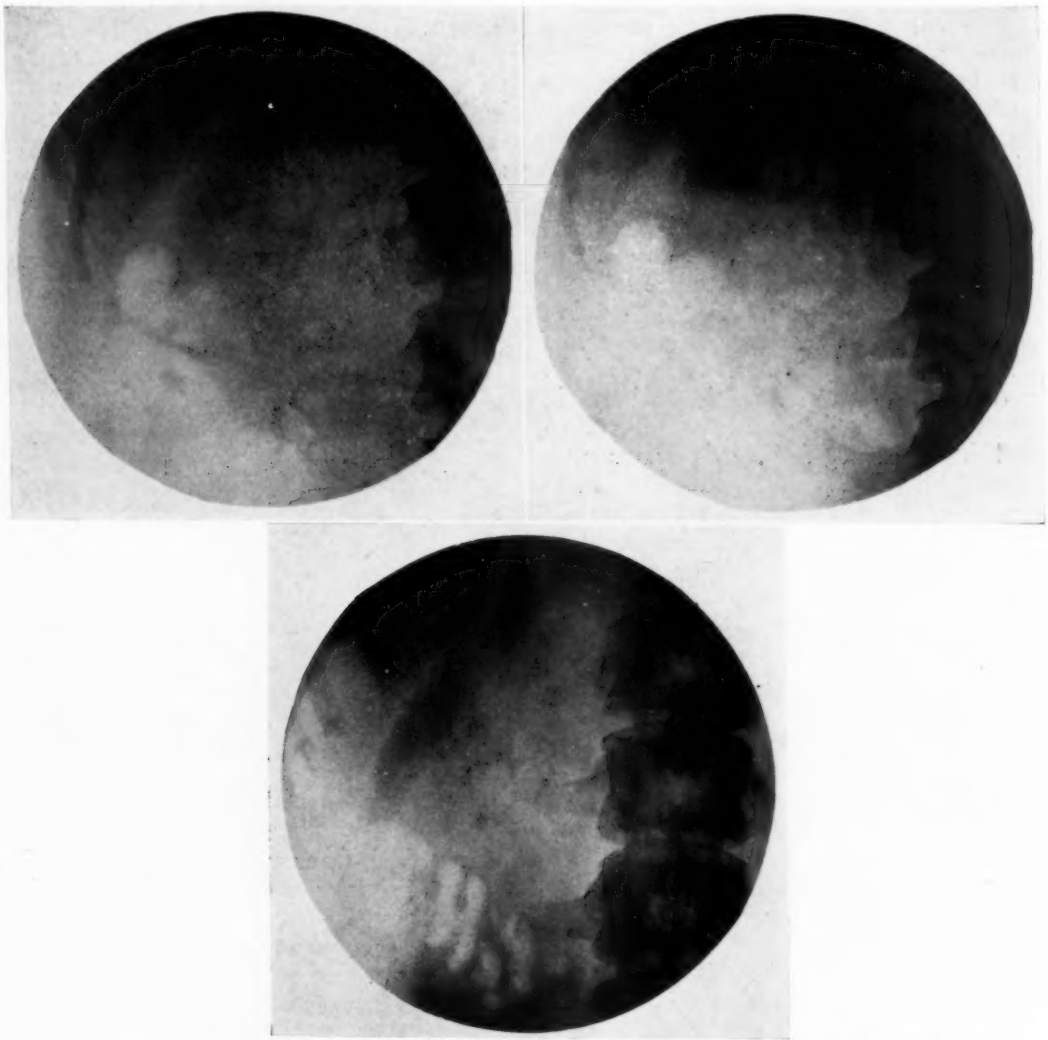

FIG. 11. Showing filling defects attributed to presence of soft stones. Unconfirmed by operation.

These interpretations were made by the surgeon and in the light of a more or less definite history of gall-bladder disease. The revised roentgen interpretation is 80 per cent correct on the same cases, and the disparity is to be explained by our relying solely on objective findings, none of which is present in those cases that have involvement of the biliary tract.

Where disease has not been chronic, or at any rate has not obstructed the cystic duct or impaired the function of the mucosa, the promise is for most interesting findings; such, for example, as mottling of the gall-bladder shadow resulting from the presence of numerous soft stones; filling defects produced by papilloma; the demonstration of a single stone in the fundus of the gall-bladder; all of which Carman and Counseller[5] encountered in their series of cases.

In the beginning of this work on cholecystography the difficult question arose of

* These 2 cases were probably the result of early intake of food or other technical faults.

interpretation of shadows so obtained. There being no precedent as a guide, it was anticipated that the opaque gall-bladder would give findings paralleling those of other hollow organs containing dense material. I believe we were too greatly influenced in our efforts at interpretation by the findings in other organs. We expected to find deformities of outline, filling defects, localized variations of shadow intensity, intensification of gallstone shadows present or suspected, impression

FIG. 12. Patient with symptoms of gall-bladder disease. History of antecedent cholecystectomy. Faint shadow (retouched) diagnosed pathological gall-bladder. Inset, photograph of removed portion of gall-bladder. Sharp, horizontal lower boundary site of amputation of gall-bladder.

of adhesions, etc. In point of fact, few or only suggestive evidences of any of these have occurred in our material (Figs. 11 and 12). Even a cursory examination of gall-bladders excised supplies the reason why this is so: they are so extensively diseased that but little of the injected dye could reach the organ. Its concentration in such an organ would be impossible. As to distortion of outline by adhesions, it may be laid down as almost axiomatic that adhesions about a hollow viscus produce such results only in the rarest of instances. Adhesions fix an organ, occasionally they displace, but only exceptionally do they deform it. If the gall-bladder possesses peristalsis, adhesions will affect this function, as in other hollow organs, by interference with its conductivity.

Finding that cholecystograms have not given the results we anticipated, we have been put to it to interpret such results as we have secured. In our material this has been fairly simple. If the series of cholecystograms are as described above, the gall-bladder is normal. Assuming reliable technique, if no shadow is obtained in the series there is a pathological condition in the biliary tract, if the shadow is present but faint, the hepatic, cystic and probably the common ducts are patent and the gall-bladder is diseased. If the shadow is

FIG. 13. On left, subacutely inflamed gall-bladder. On right, the same. There was a very small stone, which cannot be seen in photograph, in the duct.

present, either faint or intensive but of uniform size throughout the series, there is present disease of the organ affecting its wall. Persistence of the shadow beyond forty-eight hours has not been encountered enough to justify conclusions.

So far, total absence of shadow is a more reliable indication of a diseased organ than its examination as carried out at operation. Gall-bladders giving no shadow and apparently normal at operation have been found on incision not only to be diseased but to contain stones.

What cholecystography may reveal in the case of recent or acute disease and in young subjects with vague symptoms,

FIG. 14. Kindly lent by Dr. R. K. Andrews, St. Louis. Normal cholecystogram overlying kidney shadow. Fixed tender point 2 inches medial to gall-bladder shadow. Diagnosed normal.

we have yet little data from which to deduce what the findings may be. One case which was apparently in an acute phase of a questionable chronic infection showed a faint shadow of constant size and the gall-bladder was acutely inflamed.

There is one point that has been referred to which bears reiteration, and which we encountered once, that is, the failure to obtain a shadow because of occlusion of the ducts from outside pressure. Our one example of this proceeded from the presence of a large renal tumor, and that case indicated that only tumors of large size are capable of producing this occlusion. Two examples of failure to obtain shadows were in cases of chronic appendicitis with nothing suggesting cholecystic disease. There were no gall-bladder shadows. In the first, the surgeon explored the gall-bladder and found it extensively diseased. The other had apparently a normal gall-bladder. At operation it was removed and on incision there was found a small stone blocking the cystic duct at the ampulla (Fig. 13). Carman refers to the possibilities of this method of eliminating other shadows found in the abdomen from the field of pathological gall-bladder. I believe it will also be useful in establishing the location of tender points outside the gall-bladder region (Figs. 14 and 15).

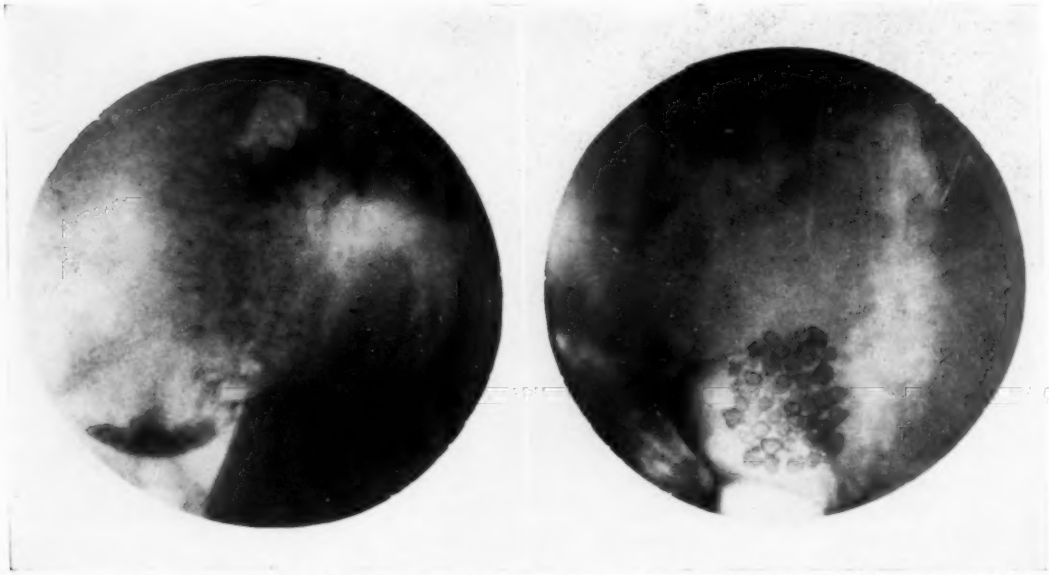

FIG. 15. Inserted to show the possibilities of sedimentation of small amount of dye in fundus of gall-bladder on change of position. On left, dense gallstones, with patient in erect position. On right, gallstones, with patient in prone position.

SUMMARY

In conclusion, I would like to point out that under most favorable circumstances and with meticulous care the

usual roentgenographic methods of examination of the biliary tract have been but 37.4 per cent correct over an eight-year period when checked by operation. Though it is true that the series to which it has been applied is not great, cholecystography has been 92.5 per cent efficient in our hands. These figures speak for themselves.

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FURTHER OBSERVATIONS ON THE ROENTGEN DIAGNOSIS OF BRONCHIECTASIS*

BY

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IN a previous report[1] presented before this society, a résumé of the roentgen findings in bronchiectasis was given, and a classification of the various types was made. This classification, based on the pathologic and roentgenologic findings, divided bronchiectasis into three types, the infiltrative, the cylindrical and the sacculated, representing different stages in the progress of the disease as seen in the roentgenogram. Further experience in the examination of these cases, both roentgenologically and pathologically, seems to render it advisable to alter the name of the first type from the infiltrative to the linear, the former being a rather indefinite term, while the latter more accurately describes the process as seen both by the roentgenologist and by the pathologist. The gradations of bronchiectasis are often slight, and the line of demarcation between the types will vary with the examiner.

The linear type represents the earliest stage of bronchiectasis, and is characterized by an increase in the linear markings along the terminal bronchi; is usually localized, and most commonly seen in the lower lobes. Pathologically this stage is represented by more or less localized congestion and peribronchial fibrosis occurring most often as an early result of bronchopneumonia, the most common predisposing factor in bronchiectasis. The linear stage is the rarest type seen, probably because the patients less frequently present themselves for examination, and because the roentgenographic findings are often so slight as to be overlooked.

The cylindrical type represents the second stage of the disease, and is characterized in the roentgenogram by a more marked increase in density along the course of the bronchi, the density being now fan-shaped in appearance and interspersed with clearer areas. The latter areas represent the dilated bronchioles and have the appearance of cavities; they vary greatly in size and number, and can usually be brought out much more distinctly by having the patient empty the respiratory tract of its contained secretions immediately before the roentgen examination. This is satisfactorily accomplished by having the patient assume the Trendelenburg position and practise forced respiratory expulsion. Although the areas of

[1] Roentgen diagnosis of bronchiectasis. Am. J. Roentgenol., 1916, iii, 524–531.

* Read at the Sixth Annual Meeting, the Central Section, American Roentgen Ray Society, Detroit, Mich., Feb. 19–21, 1925.

cylindrical bronchiectasis are usually situated in the lower lobes, it must be remembered that they may occur in any part of the lung, and a careful search should be made for them. Cylindrical bronchiectasis is unquestionably the most common type, and it is in such cases that the roentgenologist can give the most aid in establishing or excluding the diagnosis.

The third, or sacculated type, represents the most advanced stage of the disease, and is characterized roentgenologically by large pseudo-cavitations and a marked increase in the fibrous elements of the bronchial tract. In this stage there is usually involvement of the pleura; occasionally the pleural thickening is so marked as to simulate a chronic empyema. However, roentgenograms made at different angles, and especially those made with the patient resting on the unaffected side, will usually disclose the true condition. As in the cylindrical stage, drainage by forced coughing and lowering the head immediately before the examination are often of great aid to the roentgenologist.

The foregoing résumé briefly describes the roentgen findings in the various stages of bronchiectasis. It should be emphasized that the line of demarcation is not an arbitrary one, and that mixed types are constantly seen.

While authorities differ materially as to the relative frequency of bronchiectasis, it seems unquestioned that the condition is being observed more often than formerly. This may in part be explained by improved diagnostic measures and more thorough postmortem examinations. However, there is probably an increased incidence due to certain causes, such as the massive pulmonary changes incident to the recent epidemics of influenza, the use of irritative gases in warfare, the more frequent aspiration of foreign bodies, and the pulmonary fibrosis produced by intensive radiotherapy.

The symptoms of bronchiectasis are so well known that it is unnecessary to enter into detailed discussion of them, but two facts may be emphasized at this point. The chief symptoms are cough and expectoration, both of which may be so minimized by the patient as to pass unnoted in the history of the case; hemoptysis is a common symptom. In fact, in the absence of a demonstrable tuberculous lesion, bronchiectasis must be regarded as worthy of the earliest consideration in searching for the cause of bloody sputum. This may remove quite a large part of the responsibility from those bronchial varices which are so often described, yet so rarely found at necropsy.

There is wide divergence of opinion concerning the value of the roentgenologic examination in the diagnosis of bronchiectasis. This may largely be accounted for by the varying extent of recourse to routine roentgenologic examinations of the chest, the varying accuracy of the examinations and the degree of collaboration existing among the internists, roentgenologists, and pathologists.

There is no clear-cut line of demarcation in cases of bronchiectasis, chronic lung abscess and mucopurulent bronchitis, and the pathologic differentiation of the first two is not agreed upon by the pathologists. In fact, so commonly are these conditions found to be coexistent that it may be impossible to determine which preponderates. However, careful examinations, conservatism in reports, and the collaboration of roentgenologist and internist, have made the roentgen-ray examination of the utmost importance in the diagnosis of bronchiectasis.

When the affected areas are located behind the heart shadow, or are covered by an area of densely thickened pleura, they cannot be discovered by the roentgenologist, and a negative roentgen-ray report should be disregarded in the face of a definite history and physical findings, especially when the visible portions of the lung fields present a roentgenologic picture sufficiently clear to exclude diffuse bronchitis. Conversely, a roentgen-ray report intimating the presence of localized areas of bronchiectasis should not be disregarded until a most careful physical examination and review of the history have been made. The patient should be questioned carefully as to a past history of cough and the amount of sputum evacuated. It must be borne in mind that remissions are common in cases of localized bronchiectasis, so that

for long periods the patient may be free from all symptoms.

As Robertson of the Mayo Clinic has pointed out, a patient suffering from bronchiectasis is a poor risk for any procedure that necessitates his remaining in the prone position for any considerable length of time, because it is impossible to drain the bronchial secretions. The accumulation furnishes an ideal medium for secondary pulmonary infection, or may cause death by suffocation.

It has been our unfortunate experience to see, recently, several cases of acute bronchiectasis develop as a postoperative complication and terminate fatally. The necropsy findings in these cases revealed the extensive involvement indicated in the roentgenogram, and also proved conclusively that the acute process had as its basis localized areas of chronic cylindrical bronchiectasis. Had this condition been previously diagnosed, these deaths might have been averted, or at least a less favorable prognosis would have been given. The failure to diagnose the condition in these cases has caused us to search more carefully for small bronchiectatic lesions in cases in which there is a history of chronic cough.

CONCLUSIONS

1. The symptoms of bronchiectasis may be extremely indefinite.
2. The diseased respiratory tract of a bronchiectatic patient renders him a poor surgical risk.
3. It is essential to establish the diagnosis of bronchiectasis whenever possible.
4. The roentgen ray will discover and localize bronchial lesions in many unsuspected cases.
5. No other diagnostic agent can so accurately define the lesion.
6. The roentgen ray is particularly valuable in reaching a decision as to the course of treatment, whether medical or surgical, and in giving a prognosis.

ROENTGENOGRAPHY OF HYDATID CYSTS OF THE LUNG

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IN the year 1903, Dr. Caride and the writer made a roentgen examination of the first pulmonary hydatid cyst which was operated upon. The patient was a man twenty-eight years of age who had always been well until six months prior to August, 1903, when he was first seen by us. During that six months while going about his usual work, riding about his ranch and caring for his hacienda, he felt unusual fatigue and began to expectorate blood. Because of this and the clinical signs present he was thought to have pulmonary tuberculosis. He had various methods of treatment for his bloody expectoration but was not benefited, and came to Buenos Aires for treatment.

Upon clinical examination the patient was found to have dullness in the entire right lung into which no air entered and no vesicular murmur was heard.

Upon roentgen examination (Fig. 1) there was found in the right lung an annular shadow of increased density which extended from the third rib to the base and from the vertebral column to the lateral chest wall. Upon deep respiration there was seen an interval between the lower rounded border of the shadow and the diaphragm. The tumor did not move upon shaking the patient nor upon deep respiration. It had a rounded form from the upper to the lower part. Its density although not such as to completely obstruct the rays was such as to prevent the passage of even hard rays during roentgenoscopy.

Diagnosis of cyst was made and the patient was operated upon. The operation consisted in the resection of the eighth rib, opening the cyst and dissecting out the cystic membrane, leaving open the cavity until complete healing, as we had been

accustomed to do in cysts of the liver. At the end of six months the patient went home cured and had no return of symptoms during the following two years while he still remained under our observation.

The diagnosis of cyst of the lung is not aways so easy as in this case. In the first place it may be on the right or left side, in the upper or the lower lobe, and in each case the prognosis for operation is different. Cysts of the right lung have a more serious prognosis than those of the left; those of the upper lobe are more difficult of operation than those of the lower lobe because of the pneumothorax which is produced. In cysts adherent to the costal wall the cystic membrane is easier to extract than in those of the hilus.

The differential diagnosis of pulmonary cyst from sarcoma of the lung is difficult, so much so that the diagnosis must be made at operation; both clinical and roentgenological findings are identical in the two conditions. The only difference is that upon roentgen examination a cyst appears less dense than a sarcoma and in the latter the mediastinal shadow may be displaced toward the uninvolved side.

When the cyst is in the lower part of the lung and is accompanied by pleural effusion, the shadow of the effusion may be continuous with that of the cyst or may completely obscure it and prevent a diagnosis of the presence of cyst. It is possible to see a difference in the shadow of the pleural effusion and that of the cyst only when the patient is placed upon his side, and it may be in a Trendelenburg position, and the ray passes through in an oblique direction, when the rounded edge of the cyst may be distinguished as a separate shadow. But in the case of suppurative cyst this sign fails because of the presence of adhesions.

The following case is reported to show that even with clinical data it is impossible to diagnosticate cyst of the lung without aid of the roentgen examination.

A man, aged thirty-six, employed as a mail carrier who had never been in the country but had lived in the city all his life. He complains that for a year he has been spitting blood from time to time and has had a cough that interferes with his sleep. The cough is more severe when he lies on his left side than when he lies on his right. On clinical examination it is noted that less air enters the left lung than the right. There is no dullness on percussion. Some sibilant râles are noted on deep respiration in the left apex. There are no other clinical signs. The patient has slight afternoon rise in temperature, but no tubercle bacilli were found in the sputum on several examinations. The clinical diagnosis was made of pulmonary tuberculosis.

Roentgen examination showed a shadow in the entire lower lobe of the left lung

FIG. 1. Hydatid cyst of right lung.

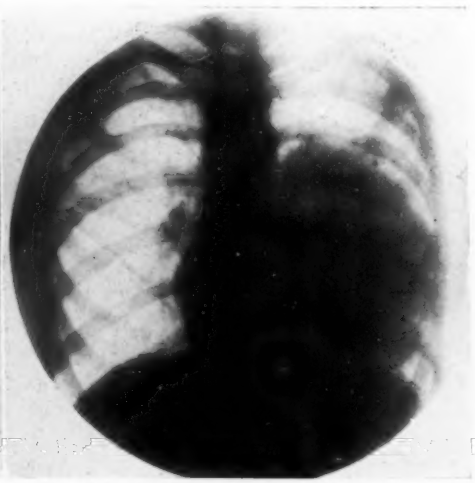

FIG. 2. Hydatid cyst of left lung.

which began at the third rib and had a rounded form with a concavity on its lower border which reached from the hilus of the lung to the lateral chest wall upon deep inspiration. The diaphragm descended independently of the shadow, making a normal excursion (Fig. 2).

As the cyst approached the surface most closely at the level of the fourth rib, this was indicated to the surgeon as the most accessible point; he was also informed that the cyst was not adherent to the chest wall.

The surgeon resected the fifth rib in the axillary region, producing an artificial pneumothorax and being unable to puncture the cyst. The patient died twenty-four hours afterward.

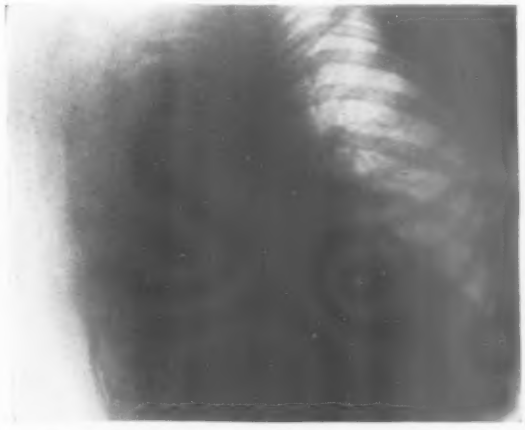

FIG. 3. Hydatid cyst adherent to chest wall.

This case shows that it is impossible to make a clinical diagnosis of pulmonary cyst and that it is essential for the surgeon to give careful attention to the roentgenological findings.

The third case which we desire to present shows that it is impossible to differentiate between pleurisy and cyst even with the roentgen-ray examination. It deals with a woman, aged thirty-two, who had always lived in the country and was occupied as a housewife. She complained of a persistent pain in the left side of the chest for which she had consulted several doctors during the preceding six months. During the last month she had had some rise of temperature in the afternoon. Six days ago, along with sharp pains in the lungs, she had had vomiting of blood, and in the bloody vomitus were some round white particles. After this every afternoon she has had chills and fever.

Upon clinical examination the patient presented all the symptoms of emphysema, that is to say, dullness on the left side, which extends upward to the level of the fourth rib, and in that part there are no breath sounds. The heart was displaced towards the right side. Besides presenting fatigue and cough she sometimes coughed up pus of a fetid odor, containing small vesicles which were found upon microscopic examination to come from an hydatid cyst.

FIG. 4. Hydatid cyst of right lung and pulmonary tuberculosis of the middle lobe of left lung.

Upon roentgenographic examination a shadow was seen extending from the fourth rib to the base of the lung which was not modified by respiration in density, form or position. The border of the heart was found displaced toward the right (Fig. 3).

Since in this case the cyst was found adherent to the chest wall the operation was not difficult. After six months of discharge of pus the condition was completely cured.

Pulmonary cyst complicating tuberculosis and cardiac lesions is often found without being previously suspected.

The following case is that of a man, twenty-four years old, in whose sputum were found tubercle bacilli in large

numbers. Upon clinical examination there were found the signs of pulmonary tuberculosis of the middle part of the right lung, and also a lesion in the left lung which was supposed to be of the same nature. But upon roentgenologic examination the lesion on the left side was found to be tuberculosis and that on the right side an hydatid cyst (Fig. 4). He was operated upon and after recovery gained in weight. We followed him for six years during which he remained well.

The pulmonary cyst, even though it may be expectorated in part, ought not to be declared healed until roentgen examination has proved the expulsion of all the cysts, in order that operation may be done if the contrary is the case. The following case confirms this statement.

A woman, aged forty-eight, came from the country. She stated that for the past five days she had expectorated a large quantity of pus, and a great number of hydatid vesicles. The pain in the shoulders had not ceased and she continued with fever in the afternoon; she had chills and fever, etc.

Clinical examination showed the signs of pleurisy on the left side. Upon roentgen examination the entire left side of the chest was found obscured. From the roentgen findings we made a diagnosis of pleurisy. There were found at operation a great quantity of pleural fluid and a large number of daughter cysts. The entire cavity drained and after a time the patient returned home. She returned in six months with pain in the same side and there was found by roentgenographic examination another cyst with a pneumothorax which had been caused by the operation. After operation she was enabled to return home entirely well.

This demonstrates that after operation on these cases of pulmonary cyst they should return for further roentgenographic examination in order to determine whether there may remain a cyst that has not been removed.

FIG. 5. Hydatid cyst, the shadow of which is continuous with that of the left auricle.

FIG. 6. Hydatid cyst of liver with extension above the diaphragm.

Cyst may be confused with other lesions which give the same characteristic shadows as is illustrated by the following case.

A man, aged thirty, had clinical signs of a cyst of the upper lobe of the lung. On roentgenographic examination diagnosis was made of sarcoma of the lung because the shadow although rounded was rough on the upper border and at the same time was so dense as to obscure the ribs. At operation a mass was found which microscopic examination showed to be actinomycosis.

The next case to be described was clinically a cardiac lesion and roentgenologically an hydatid cyst lying upon the heart and adherent to the pericardium.

A woman, aged thirty-eight, in 1911 complained of lack of energy, fatigue and palpitation. Upon examination it was found that the cardiac dullness over the base of the heart was one centimeter beyond the normal limits on the left side and above. Upon auscultation the cardiac sounds were found accentuated but in the aortic and pulmonary regions the sounds were obliterated by extracardiac sounds resembling the friction rub of pericarditis. No definite diagnosis was possible but upon roentgenologic examination a round shadow was seen which extended from the second to the fifth interspace and was nearer to the chest wall above (Fig. 5). With these data we made the diagnosis of cyst in the upper part of the chest lying upon the left auricle. In this case an artificial pneumothorax was produced as a preliminary measure and four days later the cyst was drained. The operation resulted in complete cure but the pericardial friction rub remained permanently.

The following case is very instructive because it shows the possibility of occurrence of a cyst of the lung in connection with a cyst of the liver.

The patient was a man, aged thirty-five, who complained of severe pain in the right side, and he felt that the right side in the region of the liver was enlarged. The pain was most severe on deep respiration which caused him to cough. There were no other symptoms. Upon clinical examination diagnosis was made of cyst of the liver. Roentgen examination showed the upward enlargement of the right lobe of the liver but it was noted that the tumor followed the respiratory excursions. At operation the cyst was opened on the upper surface of the liver but upon evacuating it, it was discovered that an opening extended above the diaphragm where another cyst was found and drained through the same opening (Fig. 6). This case demonstrated the necessity for examining cases of cyst in all positions, for even though one cyst may have been encountered another may be found elsewhere. It is not uncommon to find cysts occurring coincidently in both lungs.

The last reference we will make is to a case, among the hundreds observed by us, of cysts of both lungs with several large and many small cysts. The patient was a man, thirty-eight years old, who had been operated upon for cyst of the liver two years before and who had apparently made a complete recovery. A little time after the operation he began to feel tired and to cough. When he began to cough up blood he came into the hospital where diagnosis was made clinically of cyst in the right lung. Roentgen examination showed both lungs filled with cysts, only in the apices was the lung tissue free from cysts. Operation on the right side without preliminary pneumothorax secured thorough drainage of the cysts on that side; a month later the left side was operated upon. There was, however, dissemination of the cystic condition throughout the abdomen and he died about three months later.

Generalized hydatidosis is, unfortunately, very common and for such cases the prognosis is necessarily bad.

CONCLUSIONS

1. Hydatid cyst may occur in any locality of the lungs.

2. Roentgenologically pulmonary cyst appears as a rounded shadow with clear-cut borders with concavity toward the mid-line. If the border is rough and irregular the diagnosis of cyst must be doubted.

3. In Buenos Aires cysts are seen with equal frequency in men, women and children; they are as frequent on the left as on the right side; and they occur with equal frequency in the country and in the city.

STOMACH WITH TWO GAS BUBBLES

REPORT OF CASE

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THE following case report is presented because two interesting and uncommon phenomena were noted during roentgenologic examination, namely, reverse peristalsis and the presence of two gas bubbles.

CASE REPORT

Mr. Z., aged thirty-six, laborer, Polish, was kicked in the abdomen by a horse sixteen years ago. An emergency operation was performed and he felt perfectly well until 1918, when he contracted influenza to which he ascribes the onset of gastric symptoms. Practically continuously since that time he has had a feeling of distention and heaviness as if food does not digest, pyrosis, and sour regurgitation one-half hour p.c., lasting from one to three hours. Stomach feels better when empty and when bowels move freely. Constant dull epigastric pain. Epigastric cramps at irregular intervals. Feels cold and has chilly sensations up and down back and legs. Occasional headache of migraine type. Badly constipated, requiring cathartics two or three times a week. He works twelve hours a day in a wire factory in much dust, etc., one week nights and the next days. Weighed 200 lb. before coming to this country but has lost 30 or 40 lb. in last six years.

FIG. 1.

Physical Examination. Blood pressure 122/90; temperature 97.4°F.; pulse 74. Asthenic. Throat congested. Tonsils recently removed. Several crowned teeth, appear normal by transillumination. Supra- and infraclavicular fossae deeper on right side than on left. A few suspicious crackling râles over right upper lobe

posteriorly. Very stiff brachial vessels. Scar in mid-line of epigastrium. Marked gastric splash. Pendulous abdomen with weak walls. Ptosis. Appendix-epigastric reflex very marked.

Laboratory Findings. Urine negative. Ewald test meal showed 260 c.c. return; free HCl 75°; total acidity 90°; large amount fresh blood, tube passed without undue retching. Wassermann reaction negative.

Roentgen Examination. Stomach is empty at six hours, large, ptosed, active peristalsis, patent gastro-enterostomy. The pylorus is totally occluded and fixed. The antrum is dilated and contains a large gas bubble. Roentgenoscopically and in films contractions of reverse peristalsis are seen in the distal half of the stomach advancing toward the gastro-enterostomy stoma through which barium is passing rapidly. There is poor filling about the stoma. The fundus contains the usual gas bubble. Two fluid levels are present, one for each bubble. Except for colonic stasis the lower intestinal tract is negative. Chest films show general peribronchial thickening, most marked in the bases and right upper lobe. Increased hilus shadows.

Diagnosis. (1) Occlusion of pylorus with functioning gastro-enterostomy; (2) hyperchlorhydria and hypersecretion, probable marginal ulcer; (3) arteriosclerosis; (4) moderate pulmonary fibrosis; early pneumonokoniosis (and tuberculosis?); (5) habitual constipation, and (6) chronic appendicitis.

Progress. During two weeks on ulcer diet and alkaline powder has had practically no pain and has gained two pounds.

SUMMARY

A case is presented which shows:

1. Gastro-enterostomy functioning well sixteen years after operation.
2. Totally occluded pylorus, probably done at emergency operation for injury. Ten years without symptoms.
3. Two gas bubbles. The usual gas bubble is in the fundus and a second bubble is in the antrum with two corresponding fluid levels.
4. Reverse peristalsis in the antrum so that the stomach is divided into two parts functionally, the peristaltic action of both parts moving contents toward a centrally located gastro-enterostomy stoma.

COMMON CAUSES OF SHOULDER PAIN

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A REVIEW of the literature fails to reveal any effort to summarize the causes of shoulder pain, particularly from the viewpoint of the roentgenologist. These causes are considered of sufficient importance to be the subject of this paper, especially as ten of these causes, should they be present, may be demonstrated on a medium sized (10 × 12) film.

The Index to Differential Diagnosis[1] lists a great many causes of shoulder pain, which are considered but briefly and from the viewpoint only of the clinician or surgeon. No attempt has been made to show a group demonstrable by the roentgen ray.

Before discussing these it might be well to consider briefly the anatomy of the shoulder joint and adjacent structures. This joint is an enarthrodial or ball and socket articulation. The bones entering into its formation are the head of the humerus and the shallow glenoid cavity of the scapula. The joint is protected above by an arch formed by the coracoid process, the acromion and the coracoid ligament. Under ordinary conditions the joint surfaces are held in apposition by muscular action aided by atmospheric pressure. The ligaments do not participate in this function (apposition) but act only as restraining bands. The deltoid muscle is worthy of mention because of its bursa; this muscle is broad and flat and derives its name from the Greek letter *delta*, which it resembles in shape. It covers the shoulder joint above, laterally, in front and behind. Its bursa does not communicate with the joint cavity but it greatly facilitates the movements of the upper end of the humerus against the under surface of the coraco-acromial arch. The brachial plexus, however, is the most important of our anatomical considerations because most of the common causes of pain are due to mechanical irritation of this plexus at some point along its course or distribution. Furthermore, the remaining causes of shoulder pain are due to referred impulses through the plexus. The plexus is formed by the union of the anterior divisions of the fourth, fifth, sixth and seventh cervical nerves and the greater portion of the anterior division of the first thoracic nerve; occasionally a branch of the second thoracic is given to the first. The plexus extends from the lower part of the side of the neck to the axilla.

The Index to Differential Diagnosis classifies causes of shoulder pain under "direct and indirect causes." Under "direct" are given injury, arthritis, synovitis, fibrositis, myositis, neuritis, effects of exposure to cold and dampness, effects of occupations, subacromial bursitis and local muscular paralyses. The "indirect" causes are grouped under:

(*a*) Cardio-vascular lesions;—angina pectoris, aortic atheroma (luetic) and aortic aneurysm.

(*b*) Pleural, pulmonary or mediastinal conditions;—pleurisy, pneumonia, tuberculosis, intrathoracic new growth, pneumothorax.

(*c*) Gastric lesions;—flatulence, indigestion, gastritis acute or chronic, gastric ulcer, gastric carcinoma.

(*d*) Duodenal lesions;—catarrh with or without jaundice, duodenal ulcer.

(*e*) Hepatic lesions;—biliousness, gallstones, cholecystitis, nutmeg liver, new growth, acute tropical hepatitis, hepatic abscess.

(*f*) Nervous lesions;—hemiplegia, herpes zoster, acute bracheitis, caries of cervico-dorsal spine, new growth in cervico-dorsal spine, syphilitic cervico-dorsal pachymeningitis, cervico-brachial neuralgia.

Under the heading "pain in the upper extremity," this author calls attention to the following: brachial neuralgia, brachial neuritis, multiple peripheral neuritis due

to arsenic, lead, alcohol, etc., cervical rib, tumor in the posterior triangle of the neck, enlarged glands in the axilla, aneurysm of the subclavian artery, spinal tumor or spinal gliosis, neuromata or fibro-neuromata of the brachial plexus, adiposa dolorosa.

Orr[2] calls attention to the following conditions as giving rise to this symptom: pulmonary infarct, actinomycosis of the lower right lung, perforated gastric ulcer, perforated duodenal ulcer, subphrenic abscess, perforation of the gall-bladder, perisplenitis, spontaneous rupture of the spleen, acute pancreatitis, appendicitis, pressure of a drainage tube, suprarenal tumor. Kidd,[3] quoting Cushing, mentions tumor of the hypophysis, and adds hiccough and sarcoma of the suprarenal capsule. Groover, Christie and Merritt[4] have recently called attention to this symptom as occasionally being the only symptom of an apical tuberculosis. Pancoast[5] mentions the symptoms as being present in cases of new growth in the upper lung fields. Corvese[6] has recently reviewed the literature regarding this symptom with particular reference to its occurrence in cases of ruptured ectopic pregnancy. We might add that in view of the mechanism, which will be discussed later, the symptom may be encountered in the roentgenologic diagnostic procedure of pneumoperitoneum and in the gynecologic diagnostic procedure of intrauterine insufflation for determining the patency of the fallopian tubes.

Additional conditions not previously mentioned as causes of the symptoms are: hypertrophic changes of the cervical spine, calcified cervical glands, and spurs on the clavicle. In our experience, hypertrophic changes in the cervical spine have almost always been limited to the lower four bodies, rarely ever occurring in the upper three. The bony exostoses are demonstrable on the anterior corners of the bodies mostly, but the troublesome irregularities are located on the posterior corners and especially about the intervertebral foramina, through which the nerves pass. Calcified cervical glands are usually healed tuberculous glands. They may be single, multiple or conglomerate. It is not necessary that they be large to affect the nerves; the proximity of the gland to nerves is rather the determining factor. Oftentimes a small gland with inflammatory reaction about it may cause considerable pain along an adjacent nerve trunk. Spurs on the under surface of the clavicle are usually found near its outer end. The condition is not common. It may be the result of an old

FIG. 1. Aneurysm of aorta.

FIG. 2. Opaque subdeltoid bursa.

periosteal injury, with consequent spur development, or it may be congenital. The spur may cause direct pressure on the outer branch of the branchial plexus and

FIG. 3. Cervical arthritis.

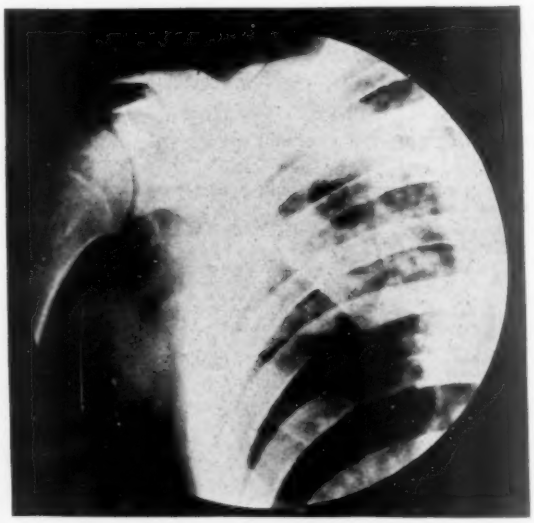

FIG. 4. Apical tuberculosis.

FIG. 5. Cervical rib.

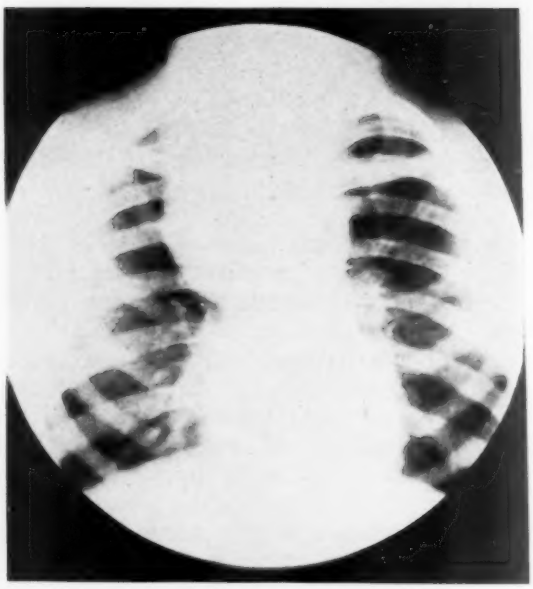

FIG. 6. Hodgkin's disease.

involve the musculocutaneous and median nerves with consequent referred pain about the shoulder and down the arm. We have seen several excellent recoveries from referred shoulder pain following removal of these spurs. In the so-called calcified subdeltoid bursitis this condition should properly be called opaque subdeltoid or subcoracoid bursitis because it has not been proven that calcium is always present in the bursa. Furthermore, we know that this opacity may disappear

after application of heat or electrotherapy, which true calcium deposit does not ordinarily do. Recently an interesting contribution[7] on this subject appeared which furnished further proof that the deposit is not always calcium but sometimes is an amorphous fat. This report seems to be more logical in that it may explain the disappearance of the deposit under simple forms of treatment.

Since the consensus of opinion appears to be that the phrenic nerve is a mixed nerve containing motor and sensory fibers in about the proportion of two to one, it is obvious that irritation of this nerve at any point in its course or distribution will give rise to referred impulses through the nerves from which it derives origin. The phrenic arises from the fourth cervical, but receives branches from the third and fifth cervicals. The distribution is chiefly to the under surface of the diaphragm, with branches or filaments to the pericardium and pleura. From the right phrenic one or two filaments pass to join in a small phrenic ganglion with phrenic branches of the celiac plexus and branches from this ganglion are distributed to the falciform and coronary ligaments of the liver, the suprarenal gland, inferior vena cava, and right atrium. From the left phrenic filaments pass to join the phrenic branches of the celiac plexus, but without any ganglionic enlargement, and a twig is distributed to the left suprarenal gland.

In the various gastrointestinal conditions enumerated, the mechanism of referred phrenic impulse is undoubtedly as above described. In the case of lesions of viscera not supplied by the phrenic, their proximity to the diaphragm is so close that any inflammatory process of these viscera may exert some influence on the terminals of the nerve. This theory of proximity does not, of course, hold true in the pelvic conditions; in the cases of ruptured ectopic pregnancy there is usually a considerable quantity of blood free in the peritoneal cavity and this, with the patient in the supine position, collects under the diaphragm causing pressure which irritates the phrenic terminals. It is not inconceivable that pneumoperitoneum and intrauterine insufflation may act in the same manner, except that the pressure is caused by air. In the mediastinal conditions pressure may be exerted on the nerve trunk. In the apical pulmonary conditions, particularly tuberculosis, proximity, as Groover, Christie and Merritt[4] have pointed out,

FIG. 7. Spur on clavicle.

FIG. 8. Apical neoplasm.

may explain the symptom, but when we consider that the pleura is supplied by the phrenic nerve, the idea of a true reference must be borne in mind. In the various cervical spine and cord lesions, as well as cervical glands, spurs on the clavicle, etc., if the origin and distribution of the brachial plexus is borne in mind the mechanism of the referred pain from these causes is at once apparent.

This brings us to our original statement that ten of these causes, should they be present, may be shown on a medium sized (10 × 12) film. The film is placed so as to include in addition to the shoulder joint, the lateral cervical region, the supraclavicular region, the upper portion of the thorax on the suspected side and the superior mediastinum. On this film we are able to demonstrate any or all of the following: caries or erosion of the cervical vertebrae, cervical ribs, cervical arthritis, calcified cervical glands, spur on the clavicle, opaque subdeltoid bursa, aortic aneurysm, apical tuberculosis, apical neoplasm, mediastinal new growth, Hodgkin's disease and, of course, demonstrable diseases or injuries of the joint itself. It must be understood that we do not make a final diagnosis of the chest or mediastinal, or certain of the cervical spinal conditions from this film, but we do glean sufficient information to make us suspect the condition and to warrant further study in the direction indicated.

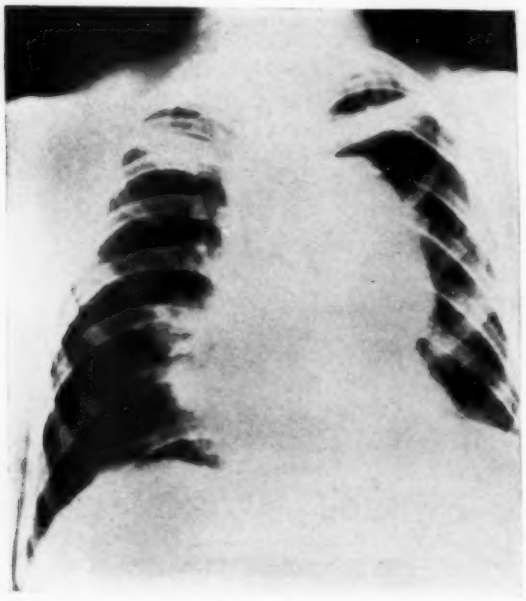

FIG. 9. Metastatic sarcoma.

FIG. 10. Calcified cervical glands.

SUMMARY

1. With proper technique any of ten or more common causes of shoulder pain may be demonstrated on a single film.

2. A 10 × 12 film at least should always be used for shoulder pain examination.

3. Shoulder pain is a symptom of many conditions, most of which are not in the shoulder region.

4. Careful investigation of these conditions should be made where there is no demonstrable cause in the shoulder region.

5. The reference is through the phrenic nerve and brachial plexus.

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CHRONIC INFECTION OF THE GASTROINTESTINAL TRACT: ITS ROENTGEN MANIFESTATIONS*

BY CHARLES EASTMOND, A.B., M.D., F.A.C.P.

IT is unfortunate for medicine that the earliest field of usefulness of the roentgen ray as a diagnostic aid lay in the localization of foreign bodies and in fractures. This early association too closely affiliated the roentgenologist with the surgeon and has been particularly responsible for what we might term the "surgical attitude" of the majority of roentgenologists. It is unfortunate indeed for medicine that this roentgenologico-surgical partnership was so early established because it has quite naturally influenced the roentgenologist to such an extent as to regard many abnormal appearances, especially of the gastrointestinal tract, as being merely variations of inconclusive interpretation, and as such having no place in that category of conditions demanding operative interference.

Interest in gastrointestinal roentgenography has been almost wholly in the detection of ulcer, cancer and disease of the gall-bladder or appendix. As a result of this possibility of diagnosing pathology to be subsequently confirmed by the scalpel, the roentgen ray has been popularized for these and kindred gross surgical conditions and the majority of patients seen by the roentgenologist are well on the way to the operating room.

It is not difficult to recall when patients suffering from lumbar pain were sent in droves to the roentgenologist for the determination of urinary calculi. After a time, roentgenologists were able to convince the clinicians that there could be demonstrated roentgenographically colonic kinks, angulations, pockets of gas retention, spasm and inflammatory changes which were responsible for the symptoms loosely attributed to the possible presence of gravel or calculi.

The time has now come when the medical profession must generally recognize that there is other pathology of the gastrointestinal tract than the orthodox gall-bladder, appendix, ulcer and cancer. There are definite changes in the gastrointestinal tract—minor if you please—provocative of as much distress and as great a degree of pathological evidence in stomach contents, stool, etc.

These changes have been seen for years on roentgen films and have been passed over as unimportant or if considered to any degree have been neither properly appreciated nor correlated. Pathologists have noted these changes as congestion, round cell infiltration and fibrosis, and the older clinicians recognized them from the clinical standpoint. It is for the roentgenologist to observe more carefully these disregarded evidences of actual pathology and to stress their importance at every possible opportunity.

The lesions of which I shall speak and which I shall attempt to correlate are those of chronic gastrointestinal infection.

The infectious origin of gastrointestinal pathology as first demonstrated by Rosenow and corroborated many times since by other observers is now well established, but too much stress has been laid on the production of local lesions in individual organs, and but very futile attempts, if any, have been made by the roentgenologist to unite these local evidences and the

* Read at the Sixth Annual Meeting, Central Section, American Roentgen Ray Society, Detroit, Mich., Feb. 19–22, 1925.

disregarded abnormal manifestations and to consider them as they truly are—roentgen evidences of gastrointestinal infection. In this lies the explanation of the fact that a patient may have an offending gall-bladder or appendix removed without relief of symptoms. Gastrointestinal infection is essentially wide-spread in its distribution, but there are favorite sites of election and these I shall consider.

STOMACH

For years, abnormal appearances of the pyloric end of the stomach of a type that is neither ulcer nor malignancy have been observed both by the roentgenoscope and on the roentgen films. They occur in the form of more or less localized filling defects usually situated on the lesser curvature immediately proximal to the pylorus and seldom over one to one and a half inches in extent. Different forms of defects or variations from the normal are present according to the extent, severity and duration of the process. The pyloric antrum is the part primarily involved. These have been attributed to abnormal forms of the mucous membrane of congenital origin or to the presence of scar tissue, the result of old ulcer, while the more general type of involvement has been looked upon as spasm.

I believe that the localized lesion of the lesser curvature is an early form of pathology of this part, and examination of tissue removed from stomachs of this type has demonstrated the presence of congestion, round cell infiltration and fibrosis. Regardless of the number of films taken or the amount of antispasmodics administered, this area never rounds out to the normal lines of the adjoining part.

Within this affected part, minute points of barium retention or local areas of exaggerated barium density may be observed. Roentgenologists have, as a rule, been divided into two classes in regard to the interpretation of this condition; they have either passed it over as a spastic affair, or in view of the minute crater formation, have considered it a prepyloric ulcer. I feel that, although it is an erosive condition, it should be given the term "ulcerative gastritis."

The second type is that in which there are no localized serrations nor defects in the marginal filling of the stomach, but the pyloric extremity for a distance of two to three inches is smooth, contracted and shows an alteration in the character of the peristaltic waves. The pyloric antrum, instead of being emptied by a continuation of the sharp orderly contractures of peristalsis empties by a broad general contraction. Under manipulation it is frequently impossible to cause this part to round out to normal proportions; or if it be possible to fill it completely by pressure, as soon as the pressure is removed the old contracted form returns; or if the patient be in the erect position, the barium drops into the dependent portion of the stomach. What do these changes indicate? There is a definite loss of elasticity of the stomach wall and the contractility of the part is diminished to a marked degree. The condition is one frequently spoken of now as "stiffening," this stiffening being nothing more than chronic round cell infiltration and fibrosis.

The surgeon is familiar with this abnormal appearance of the stomach in gall-bladder cases, but in a different way. He sees the part congested, the serosa being of a deeper hue and the superficial vessels engorged to a considerable degree—the so-called "red stomach." There is a different sense of resistance to the examining hand—there is rigidity of a greater or less degree. The term "stiffening" has been well chosen.

DUODENUM

Non-ulcerative deformities of the duodenum (by that I mean deformities not assuming any of the characteristic types recognized as being indicative of duodenal ulcer) have been considered to be the result of adhesions secondary to pericholecystitis. While the gall-bladder is usually *coincidentally* involved in the infectious process, I feel that the changes which I shall mention are not the result of extrinsic interference, but rather that they are changes within the duodenal wall itself and that when adhesions occur they arise from the serosa of the duodenum rather than

originate about the gall-bladder and secondarily involve the duodenum.

All manner of deformities, non-ulcerative in character, are observed—flattening of one side or the other, elongation or increase of the transverse diameter, inconstant irregularity of form. One of the most common features is that the pyloric cap changes its form from time to time, but never assuming the normal. This again is due to the same type of change which is present in the pyloric end of the stomach as would be expected because of the similarity of structure—a chronic round cell infiltration with fibrosis, diminishing the elasticity of the wall and interfering markedly with its normal expansile properties, the constant contracture being due to a predominance of the fibrotic elements.

As in the pyloric end of the stomach, so in the first portion of the duodenum or cap there may be irregularity of the lesser curvature side, more or less constant, with the presence of minute craters approximating the size of a match-head. These should not be considered as cases of duodenal ulcer but should be viewed in the same manner as those similar lesions in the stomach and be termed "ulcerative duodenitis." The well known disappearance of these craters within a few weeks under medical treatment substantiates this view. Again, when adhesions are present, they are the result of periduodenitis arising from an extension of the inflammatory process through the duodenal wall.

The second portion of the duodenum, being intestinal, assumes an entirely different form. Observation of the abolition of the rugal markings with or without constriction of the part, and an altered emptying rate is an everyday occurrence. This again is the result of chronic inflammatory changes secondary to infection, and we find it almost invariably associated with chronic gall-bladder pathology.

When one considers the intimate relation of this portion of the duodenum to the gall-bladder, it is to be expected that infection of the one organ will affect the other. When abnormal fixation of this portion is demonstrable, it is usually the result of periduodenitis, but I feel that a pericholecystitis may also be a factor in the formation of the adhesions. So intimate is the relation between the gall-bladder and second portion of the duodenum that the roentgenologist rightly considers deformities or abnormal fixation of this part to be indicative of chronic gall-bladder disease, but the situation here is one of co-existence of disease rather than cause and effect.

ILEUM

A great variety of abnormal conditions of the terminal ileum has been described by various observers. We have had the kink, the veil, abnormalities of the meso-appendix, and numerous other *external* conditions influencing the part, but I feel that the question of *intrinsic* ileitis has been grossly overlooked.

The process here is the same as that in the second portion of the duodenum—a rigidity, a lack of elasticity and an alteration of the rate at which the barium passes through the part. On the roentgenograms there may be a full-calibred intestine with the rugae flattened out so as to present a smooth-walled margin, or later in the history of the condition an irregularity of form more or less constant and diminution of the size of the lumen from contracture. This contracture like those higher in the tract is not affected by the use of antispasmodics. The condition is not one of spasm but one of congestion with small, round cell infiltration, fibrosis and more or less cicatricial narrowing.

CECUM

Cole of New York, in a discussion of the roentgen aspects and roentgen evidences of chronic pathology of the appendix, mentioned deformity of the inner side of the cecum as being one of the strongest diagnostic points, even stronger in his judgment than the visualization of the appendix itself with the demonstration of pathological alterations of its lumen. However, while this deformity of the cecum—again undue rigidity, concave contracture especially of the inner side with resulting inefficient expulsive power and cecal retention—is seen associated with appendicial pathology, it may develop

subsequent to the removal of a diseased appendix.

These changes of infiltrative or sclerotic type may involve a considerable portion of the inner side of the cecum so as to include the ileocecal valve. Under such circumstances, ileocecal incompetency is a usual accompaniment, as one would expect upon considering the nature of the process and the parts present. Not only does the stiffening and thickening of the intestinal wall produce distortion of the margins of the valve but the leaves of the valve, being of the same structure, contiguous to and continuous with the wall of the cecum, share in this same process. Because of their sclerotic condition with lack of pliability, they are unable to approximate sufficiently to produce complete closure against the normal retrograde or retroperistaltic movement of the intestinal contents toward the cecum.

This aspect of ileocecal incompetency has not received sufficient attention.

COLON

Chronic sclerotic changes in the colon have long been recognized as the result of chronic infection of some type. Roentgenologically, the lack of elasticity or the irregular contraction is very evident. The most common site of the lesion is in the sigmoid, probably because that is the portion of the intestine in which there is fecal retention with consequent increased opportunity for bacterial invasion.

A few years ago, in an article on diverticulitis of the colon published from the Mayo Clinic, a condition of multiple minute abscess formation of the mucosa and muscularis was described. In view of this which is undoubtedly a condition resultant from infection, I feel that certain cases of diverticulosis may be an extension of this process or, in other words, also a late manifestation of chronic infection.

All these lesions of the gastrointestinal tract which I have mentioned, representing pathological changes subsequent to infection, are clearly and definitely demonstrable by roentgen examination.

I do not wish to convey the impression that all cases of infection of the gastrointestinal tract present lesions at all the sites which I have enumerated, but there is a multiplicity of lesions in such a vast majority of these cases that the entire situation is aptly termed "chronic gastrointestinal infection."

CANCER OF THE TONGUE AND MOUTH*

BY CHANNING C. SIMMONS, M.D.

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AT the present time a great deal of interest is being taken in cancer,—and especially in one of the more common forms of the disease,—cancer of the mouth. Taking into consideration the increased length of life at the present day, and also the more accurate means of diagnosis at our command, the mortality from cancer has increased slowly but steadily, and at present is nearly equal to that of tuberculosis. Roughly, at present there are 100,000 deaths a year from cancer in the United States.

Cancer of the buccal mucosa is usually one of the most malignant forms of the disease and a large proportion of the cases are incurable when first seen by the surgeon. Assuming that surgery is the proper treatment Judd[1] estimates the operability of the cases seen at the Mayo Clinic as 40 per cent. At the Massachusetts General Hospital it was 65 per cent. In a series of 103 cases of cancer of the tongue seen at the Collis P. Huntington Memorial Hospital in the three years from 1918 to 1920, in which the hospital examination represented the first consultation of the patient with the physician, in 76 there was evidence of metastases in the glands. In 19 of the remaining 27 some form of surgical operation was performed, but in many instances the radical operation was not done as the patient's general condition did not warrant the dissection of the neck. Of these 19 cases 5 are now living and free of the disease. Of the remaining cases treated with radium and roentgen rays all are dead. This gives an operability of 19 per cent, with something over 25 per cent cures. On the other hand, considering all the cases, the percentage of cures drops at once to 5. During this same three-year period there were 379 cases of cancer of the buccal mucosa observed at the Huntington Hospital. There are always certain conditions which affect the operability statistics of a given hospital, but it would seem that the estimate of 40 per cent made by Judd is probably not far from correct.

To lower this rather appalling mortality of cancer of the tongue it is necessary to educate the public in the early symptoms of cancer and to seek advice on the first premonition of trouble. It is also necessary to educate the physician and the dentist to recognize the disease, and I regret to say the surgeon, to treat the cases according to modern methods. Bloodgood[2] found that 50 per cent of a series of cases of cancer of the tongue received poor advice from the first man consulted. Farr,[3] in a series from the New York Hospital, found that 66 per cent received poor advice. In 1920 we (Simmons and Daland)[4] studied 519 cases of cancer of all organs entering the Massachusetts General Hospital, in an attempt to determine why the statistics in relation to cure were so discouraging. It was found that the average duration of the disease when the patient entered the hospital was 12½ months. In cancer of the breast the average duration of the tumor was 11½ months. This delay was partly due to the patient and partly due to the ignorance of the first physician consulted. A similar study made four years later[5] showed that the duration of the disease when the patients entered the hospital was one month less. The improvement on the part of the patient was 14.5 per cent and on the part of the general practitioner 3 per cent. I believe that the improvement in these figures was partly due to the educational campaign of the American Society for the Control of Cancer. It is probable that any lowering of the mortality of the disease when situated in the mouth will be due more to early diagnosis and prompt radical removal than to any change in the present accepted methods of treatment.

We know that chronic irritation has a distinct relation to cancer and this is particularly true in cancer of the mouth. In a personal series of 189 cases of cancer of the tongue some form of chronic irritation was mentioned in 65 per cent. The use of tobacco in some form is almost universal among men and while the mucous

* Read at the Sixth Annual Meeting, Central Section, AMERICAN ROENTGEN RAY SOCIETY, Detroit, Mich., Feb. 19–21, 1925.

membrane of the mouth will tolerate it in most individuals, in some it seems to be particularly sensitive. It is surprising to find how many chew, and it is not unusual to find cancer of the cheek on the side on which the quid is held. Tobacco is a distinct etiological factor in leucoplakia, a pre-cancerous condition, which often clears up if the use of the drug is prohibited. Carious teeth and pyorrhea are almost universal in the class of patients seen in a hospital clinic. Cancer of the floor of the mouth is seen in carpet layers who are in the habit of holding tacks beneath the tongue. Irritation from poorly-fitting tooth plates and other forms of dental apparatus is a common etiological factor. This does not necessarily imply that the dentist is at fault but usually means that the patient has not reported to have the apparatus adjusted as the shape of the jaw changed.

Syphilis has a distinct relation to cancer in the mouth. The Wassermann reaction was found positive in 14 per cent in a personal series of cases, and in a series reported by Quick, 40 per cent. In the tongue, cancer arises in old specific scars, in gumma or in an area of specific leucoplakia, and cancer and syphilis are often present at the same time. The appearance of the tongue in these cases is usually characteristic and the cancerous areas are apt to be multiple. If the Wassermann reaction is positive and there is any doubt about the lesion of the tongue it should be treated as cancer as well as given specific treatment. If the diagnosis of carcinoma is incorrect little harm has been done, but personally I can only remember one instance in which a suspicious ulcer did not prove to be malignant. If these patients receive specific treatment only, the appearance of the tongue will improve remarkably as the syphilitic lesion clears up, but at the same time the cancer is slowly increasing and much valuable time may be lost before proper measures for its control are instituted. In dealing with cancer in the mouth I prefer to speak of "cancer of the buccal mucosa" rather than "cancer of the jaw, cheek, tongue, etc.," as the tumor must arise from the mucous membrane, and the etiology, pathology and treatment are essentially the same wherever it originates. Cancer in the upper jaw, arising in the antrum, is an entirely separate problem.

Pathologically, all these growths are squamous cell cancer, but clinically, two definite types are seen. The first is the papillary type of relatively low malignancy and slow growth, which forms metastases comparatively late. The second type is the rapidly growing form which metastasizes early and is often incurable inside of six weeks from its onset. Broders,[6] in 1920, in reporting a series of cases of cancer of the lip from the Mayo Clinic, graded the specimens into four groups of malignancy, as determined by the amount of differentiation of the cells. The percentages of cures in these groups were 95.5 per cent, 79.3 per cent, 35.1 per cent, and 0 per cent. In a paper by Simmons and Daland,[7] reporting the results of cancer of the lip at the Massachusetts General Hospital, the same fact was found to be true. More recently, Greenough[8] has reported a series of cases of cancer of the breast from the Massachusetts General Hospital. When the specimens were graded according to the differentiation of the cells the percentage of cures was found to be 60 per cent, 43 per cent, 27 per cent and 0 per cent. This was irrespective of the age of the patient, the duration of the growth or the operation performed. Martzloff[9] has also verified this observation in a series of cases of cancer of the cervix. I believe this fact is very important and throws a new light on the study of the disease. Unfortunately, it makes a good deal of the work previously done of little or no value.

Cases of carcinoma of the mouth can probably be grouped in the same manner, and a prognosis given by the pathologist after examination of the specimen. There should be a much closer relation between the pathologist and the surgeon, however, than there is at the present time. The clinician is usually satisfied with the diagnosis of cancer and the laboratory worker often scorns the clinician. No surgeon should accept a diagnosis of cancer only, but should demand to know the grade of malignancy, the extent of the growth and the possible chances of cure. Clinically,

in the mouth the malignancy apparently varies somewhat as to position. Carcinoma in the floor of the mouth appears to be the most malignant type; carcinoma of the lower jaw, cheek and upper jaw, relatively less so in the order named. This may be due to the fact that the papillary or low-grade type of cancer is much more common on the cheek and hard palate than on the tongue. One form of cancer of the mouth often overlooked and usually first seen by the dentist, is that arising in the fold of mucous membrane about the tooth. The bone is early invaded and the first symptom is usually a loosening of the tooth. The tumor is often mistaken by the dentist for granulation tissue. Another form of cancer of the tongue at times difficult to recognize is that arising in the large papillae at the base of the anterior pillars of the fauces. Inflammation of these papillae causing considerable discomfort is not at all unusual, and occasionally cancer is seen arising at this point. The difficulty in treating cancer about the mouth is, first, the local infiltration of the tumor into the vital structures and, secondly, metastases. Unlike cancer in the breast, metastases rarely occur beyond the regional lymph nodes, on the same side of the body on which the growth is situated. Cross metastases, however, do occasionally occur, as do also remote metastases in the later stages of the disease.

Cancer of the mouth in its early stages is a symptomless disease and, in fact, there are no symptoms caused by cancer itself in its early stage in any part of the body. All symptoms are due either to interference with the function of the organ, involvement of nerves, vessels or other vital structures, or to secondary pyogenic infection. The first objective symptoms vary. In the tongue cancer is a painless ulcer or tumor; in the breast a painless tumor; in the uterus bleeding, etc. The symptoms of cancer commonly given in textbooks are those of the advanced disease and are very misleading to the student. Any simple ulcer of the mouth that does not heal readily in two weeks after the removal of the probable cause should be considered as cancer and treated as such. A few mistakes will be made but many lives will be saved. In certain cases it is possible and justifiable to remove a specimen of a doubtful growth for biopsy, but in general this should be discouraged. It is better and not much more difficult to remove the entire growth if there is a question of diagnosis. Little harm is done if the tumor is benign, while, if it is cancer, a second local operation is not necessary.

The relation of syphilis to cancer of the mouth has been discussed. Tuberculosis, actinomycosis, foreign body, and simple ulcer are about the only other conditions that can be confused with cancer. Tuberculosis is usually painful from the beginning and nearly always associated with tuberculosis elsewhere in the respiratory tract. It is very difficult at times to distinguish from cancer.

At its inception cancer is a purely local condition and if seen and treated, that is, completely destroyed at that time, the patient will be cured. At present, the generally recognized method of treatment is surgical excision in some form, modified to suit the individual case. The local growth can also be destroyed by radium, fulguration, diathermy, roentgen rays, etc., and these are the treatment of choice in certain selected cases, but surgery has cured more cases of cancer than any other one method of treatment, and it is necessary to show good reason for the departure from this method before others are instituted. In cancer of the mouth, if the growth is small, surgical excision with or without cauterization in some form is more rapid than radium treatment, much less painful, and I believe the results are better. A pathological examination of the tissue is thus made possible. The operative risk is slight and if necessary a large part of the tongue can be removed under local anesthesia. The resulting pain and interference with function is much less than one would expect. I know that most radiologists and many clinicians will not agree with this but I have yet to be convinced that when an attempt at radical cure is to be made, surgery followed by radiation is not the best method of treatment. By cure is meant the removal or destruction of every cancer cell in the body and it has not yet

been proved that radiation will do this without destroying the normal tissue as well. A local nodule of the growth may be destroyed by beta radiation, and fibrosis about a deeply situated nodule occurs from gamma radiation, but living cancer cells will be found in the center of this fibrous mass. It is necessary for the surgeon who is treating any case of malignant disease at the present time not only to know surgery but also to understand the application of radiation treatment. The proper employment of radium in the treatment of carcinoma is in many instances a surgical procedure, and it is also necessary for the surgeon to know the value of pre- and post-operative roentgen treatment.

The treatment of cancer of the mouth falls into three classes: prophylactic, curative and palliative. If oral cleanliness were more universal there would be less cancer of the mouth. Carious teeth, and poorly-fitting dental appliances should be cared for and tobacco prohibited if not well tolerated by the mucous membrane. All areas of leucoplakia should be watched, and obviously non-malignant tumors treated. When cancer is present the cases fall definitely into two groups: those in which an attempt at radical cure is justified and those in which palliation and prolongation of life only is to be expected. It is unwise to subject the advanced cases to a radical surgical operation as it is apt to disseminate the growth and only hasten the end, as well as increasing the suffering of the patient. Roughly speaking, if there are clinically enlarged cancerous glands in the neck the case is not suitable for an attempt at cure by a radical operation, but this statement does not apply to carcinoma of the lip. I have cures, however, in which metastatic cancer, which could not be demonstrated clinically, was found on pathological examination.

The following is a summary of the methods of treatment usually employed at the Massachusetts General Hospital and the Huntington Hospital for the past five or six years: All patients receive a hypodermic of morphine one and one-half hours before operation, and a second combined with atropine one-half hour before operation, the amount given being governed by the body weight of the patient. Ether is employed as an anesthetic, given by the pharyngeal tube method, the pharynx being packed off. All cases receive postoperative roentgen-ray treatment of the glandular areas of the neck. Preoperative roentgen treatment has been abandoned as, unless at least two weeks is allowed to elapse between the exposure and the operation, the healing of the wound is apt to be unsatisfactory.

Pre-cancerous Lesions. (These include superficial ulcers, non-malignant tumors and papillary areas of leucoplakia.) Intrabuccal excision of the growth and closure of the wound with black silk sutures. Silk is used in preference to catgut, as it is more dependable and can be easily removed.

Very Early Cancer. Intrabuccal excision of the growth and thorough cauterization of the raw areas with actual cautery. For cautery a small jeweler's soldering iron is used. These retain their heat in the presence of blood and saliva and it is possible to actually destroy tissue at a considerable distance from the cut edge. They are more satisfactory than the cautery knife. I have had little experience with diathermy but while in superficial lesions the operation is bloodless I feel that it does not destroy enough tissue. If the growth is in an inaccessible position the cheek is split. Following operation there is considerable slough which separates in about ten days and the wound heals by granulation. The scar is soft and the interference with speech less than would be expected. Secondary hemorrhage occasionally occurs at the time of the separation of the slough and although alarming has never proved serious. The lingual artery can be tied if necessary.

Excision of the upper and lower jaws has been done in the classical manner and the defect corrected by some form of apparatus which should be fitted early before deformity from scar contraction has taken place. In the very early cases of carcinoma of the mouth, where the cells show considerable differentiation, it is not necessary to do a radical dissection of the glands of the neck.

Early Carcinoma. Intrabuccal excision and cauterization of the local lesion,

followed ten days later by a radical dissection of the neck, removing the sternomastoid muscle, the internal jugular vein and all glands from just above the clavicle to the base of the skull. If the operation is done thus, in two stages, the mortality is low and the resulting deformity not great. Radium is not implanted in the wound, for, if the operation is radical there is no place for the seeds except in close proximity to the carotid artery or other vital structure. Theoretically, the neck dissection should be performed before the local growth is excised, but, practically, it has been the custom to do the intrabuccal operation first, since, if there is any postoperative complication following the neck operation, it may be necessary to postpone the removal of the local growth for some time. The patients are in the hospital as a rule about three weeks.

Early cancer, but cases in which the physical condition of the patient does not warrant the radical two-stage operation. Intrabuccal excision and cauterization of the growth, and roentgen treatment of the glandular areas of the neck.

More advanced cases of carcinoma with obvious metastases, but in which the local growth can be completely removed. Intrabuccal excision of the growth with cauterization, and roentgen irradiation of the glands of the neck.

Inoperable Carcinoma. Radium treatment to the local growth and roentgen treatment to the glands of the neck. The radium should be employed as "seeds," capillary glass tubes about 1 × 3 mm., containing one or more millicuries of emanation. The seeds are introduced into the growth by a hollow needle and each seed thus introduced destroys about one c.c. of tissue. From five to ten seeds are used depending on the size of the growth, and the result following the first treatment is much greater than subsequent ones. There is considerable reaction and discomfort, particularly if the seeds are not introduced well into the tissues. By this method of treatment life may be considerably prolonged and the patient made more comfortable. The surface application of radium is inadequate in the treatment of cancer of the tongue and the use of seeds containing emanation is much more satisfactory than the introduction of needles.

Postoperative Recurrence. These cases are treated as cases of inoperable carcinoma.

RESULTS

It is very difficult to make a fair statement of the results of any one method of treatment as so many factors have to be considered in each case. If early and low-grade cases are alone considered, the results will be good by any method of treatment, but if the operator is enthusiastic and attempts a radical cure in advanced cases his results will be poor. All surgeons have had an unexpected cure of an individual case of cancer of the tongue, breast or rectum where the disease has apparently been hopeless. The study of large groups of cases has distinct scientific value clinically, but it is almost impossible to compare series of cases reported by one man with those reported by another. For this reason a form was adopted in 1909 by Greenough, Simmons and Green[10] in reporting a group of cases of cancer of the mouth in the Massachusetts General Hospital, which has been satisfactorily employed in reporting several subsequent series of cases of malignant disease. The chief requisite of this form is that every case observed during the period of time included in the report shall be included in the report, and that no case shall be considered as cured who is not living and free from disease for three or more years after the last treatment, and unless the clinical diagnosis has been confirmed by a pathological examination. Realizing the value of reports made along these lines the American College of Surgeons has recently drawn up form cards for the report of cases of cancer of the uterus, breast and mouth which have been supplied to certain hospitals and will allow the study of large groups of cases reported along the same lines.

In September, 1924,[11] I reported the results of the operations on 53 consecutive cases of cancer of the mouth performed in 1918–1920, and I am including the table of results in this report. It is very much condensed for the sake of clearness and

probably makes the percentage of cures somewhat less than they really are.

RESULTS OF OPERATIONS

Cancer of the Buccal Mucosa	Three Years 1918–1920	
Tongue, 26 Cases.		
Died of disease	19	
Living with disease	2	
Died without disease	2	
Living without disease	3	12.5 per cent cures.
Lower Jaw, 8 Cases.		
Postoperative death	1	
Died of disease	5	
Living without disease	2	25 per cent cures.
Cheek, 13 Cases.		
Died of disease	6	
Living without disease	7	52 per cent cures.
Upper Jaw, 5 Cases.		
Died of disease	2	
Died other cause over 3 years	1	
Living without disease	2	60 per cent cures.
Tonsil, 1 Case.		
Died 2½ years after operation of strangulated hernia. No recurrence.		

TOTALS

Total 53 Cases.			
Postoperative death	1		
Died of disease	32		
Living with disease	2		
Died less than 3 years without disease	3		
Died over 3 years without disease	1		
Living 3 or more years without disease	14	30 per cent cures.	
Three cases, one dead and two living with disease are cases of reoccurrence.			
Radical operations	19	well 6	31.5 per cent
Palliative operations	29	well 9	31 per cent
Operability, Massachusetts General Hospital (57 cases)			65 per cent
Operability, Judd from the Mayo clinic			40 per cent

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ROENTGEN TREATMENT OF CHRONIC SPONDYLITIS DEFORMANS (CHRONIC SACROILIAC LUMBALGIA OR CHRONIC VERTEBRAL RHEUMATISM)*

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THE simple term "lumbago," as a rule, has led us into disturbing variations of thought. The study of the anatomy of the spine and nerve roots of the lumbar section of the spinal column has by no means been entirely exhausted, and although many theories have been expounded from time to time, none has appeared to be adequate. Then again, there has been considerable confusion regarding the pathology. Almost every writer seemed to take a delight in using a different name for the same pathological entity.

A review of the literature shows nothing of value in the roentgen treatment of chronic spondylitis, except a few reports by the French.

It is logical to hesitate at the acceptance of cases under the nomenclature of "chronic lumbago," "lumbago-sacralgia," "rhizomelic spondylosis," "sacro-iliac lumbalgia," "rachialgia," "vertebral arthritis," "vertebral rheumatism," "lumbo-coxarthralgia," "sacro-iliac arthritis" and "generalized sciatica." It is not unlikely that the majority of these cases are true spondylitis, and are farther advanced than they are usually suspected to be.

W. Cabell Moore[4] says, "Lumbago is a handy and acceptable term to use in describing such a backache to laymen, and often therefore the situation is allowed to rest at this, but as a rule lumbago, unqualified, is not an accurate diagnosis. Whatever the condition is, a myositis, a fibrositis, a neuritis, or an arthritis, it is generally the result of focal infection plus exposure or strain."

Chronic lumbago, as a rule, resists all usual therapeutic measures. Physiotherapy, hydrotherapy, massage, electricity, light baths, vapor baths and similar methods are all tried, and then as a final resort, local injections and surgical interference are reached.

Local epidural injections of iodipin, alcohol with antipyrin and physiological saline solutions at the level of the affected intervertebral space have been used to some extent, but the results have not been very encouraging. The last resort has usually been surgical intervention, the most rational being a decompressive laminectomy. In this way the intervertebral foramen is freed and the nerve released from compression or irritation.

Sicard is convinced that chronic lumbago, like sciatica, is a pathological state of the intervertebral foramina resulting in an inflammation of the nerve which he designates as *funiculitis*. In other words, this is an inflammation of the foramina with an articular priority in time and a secondary reaction of the nerve roots. The author maintains that lumbago, and ordinary sciatica of a rheumatic nature do not have a radicular origin in the sense that Dejerine and his followers use, namely, an irritation of the nerve roots in their course through the arachnoid and pia mater, but that they are caused, on the contrary, by an irritation in the intervertebral foramen. The extrameningeal funiculitis (inflammation of the nerve roots) is thus opposed to the intrameningeal funiculitis. The space contained in the intervertebral foramina, therefore, would be the seat of the lumbago, and in view of the fact that the spinal cord does not appear to play any part therein, the communicating canals, nerve ducts and nerve roots outside of the dura mater which traverse these canals, alone are responsible.

Barré and Gunsett[1] dissected the region of the intervertebral foramina of a case and found that the two nerve roots are encased in the dura mater, and pass through the groove to the intervertebral foramina. In the lumbar region the nerve passes obliquely through the intervertebral

* Read at the Sixth Annual Meeting, Eastern Section, AMERICAN ROENTGEN RAY SOCIETY, Atlantic City, N. J., Jan. 22–24, 1925.

foramen. At the exit from this foramen the nerve extends along another groove (gouttiére) for several centimeters, and the fifth lumbar nerve is found in an actual canal, the walls of which fit snugly.

Bearing in mind the fact that the nerve is surrounded in all parts by abundant veins which form a continuous network with very little fat tissue, we can conceive how the venous congestion, the least tissue inflammation, the minutest local periostitis, or the smallest osteophyte, may directly affect the nerves.

FIG. 1. Typical "parrot beak" shadows of lumbar vertebrae of productive osteitis.

FIG. 2. Anterior and posterior shadows. Note the anterior productive beaks. The posterior ligamentitis is demonstrated by the calcification of the supraspinous ligaments.

In the discussion of intervertebral foramina Gordon states, "When one considers the very close proximity of the apophyseal articulations, the very frequent change of position of individual vertebrae in flexion, extension, and other positions of the body, the possibility of a rheumatic, gouty and other toxic changes in the bony tissue, one must expect a pronounced vulnerability of the enclosed nerve, especially when it is not protected by a subarachnoid space filled with fluid, such as we find in the roots themselves. This nerve-segment may become involved secondarily to pathological modifications or to an inflammation of the surrounding bone and ligaments in all sorts of vertebral affections, such as Pott's disease, cancer, spondylitis of any origin, traumatic lesions, etc.; it may also follow a morbid state of the enclosed adiposocellular tissue in the midst of which the nerve lies. The nerve may be then irritated, compressed, twisted or pulled."

The general causes, infectious or toxic, which were readily accepted a few years ago, have been replaced by more definite factors which demonstrates that the roentgen ray shows osseous, ligamentous or articular lesions. But the treatment of spondylitis by roentgen rays has not yet

been generally accepted even by the French, although Babinski, Delherm and Charpentier have reported cases which they cured by roentgen therapy.

Péhu and Daguet[6] prefer the term "chronic spondylitis with an ankylosing tendency." The pathology of the back which they studied corresponds to *chronic vertebral rheumatism* described by Teissier, and to the *rheumatic spondylosis* of Forestier of Vichy. They say: "We believe that lumbarthria, chronic ankylosing spondylitis, chronic rheumatism of the spine with more or less extension, and rhizomelic spondylosis are only variations of one and the same disease. It is chronic progressive rheumatism whatever its etiology may be."

The etiological conditions of these forms of spondylitis are quite characteristic: The age is around forty; the patients show no pathological antecedents, no tuberculosis and no gonorrhea; many give a history of having sustained a trauma.

The disease develops in the course of several years, manifested by periodic attacks of pain in the back, first affecting the sacro-coccygeal or lumbar region. These periodical pains last rather long, generally several months, and then disappear. As a rule, the pain is paroxysmal and appears to be much more bearable after ankylosis has taken place. These spinal pains are frequently accompanied by pain in the legs and joints, but that does not, by any means, indicate that the joints are affected in the same way as the vertebrae. When the disease has completely developed, the patients present a varying degree of kyphosis and a lateral inclination of the head. Tremor is absent and the movements of the head are limited and painful.

Roentgen study of the lumbar spine gives considerable information concerning the normal or abnormal conditions of the spine such as the vertebral processes, osteophytes, bone spurs, ossification of ligaments; the wearing away or the collapse of the bodies of the vertebrae; changes in the intervertebral discs; numerical modifications of the vertebrae; the possibility of enlargement of the vertebral processes; sacralization or lumbalization, etc.

The roentgen study of the midline of the vertebral column shows in some instances an opacity of the supraspinous ligaments, while in other cases fascicular hypertrophies can be shown. The interspinous ligaments are also visible in some cases, but they are usually very difficult to diagnose roentgenologically.

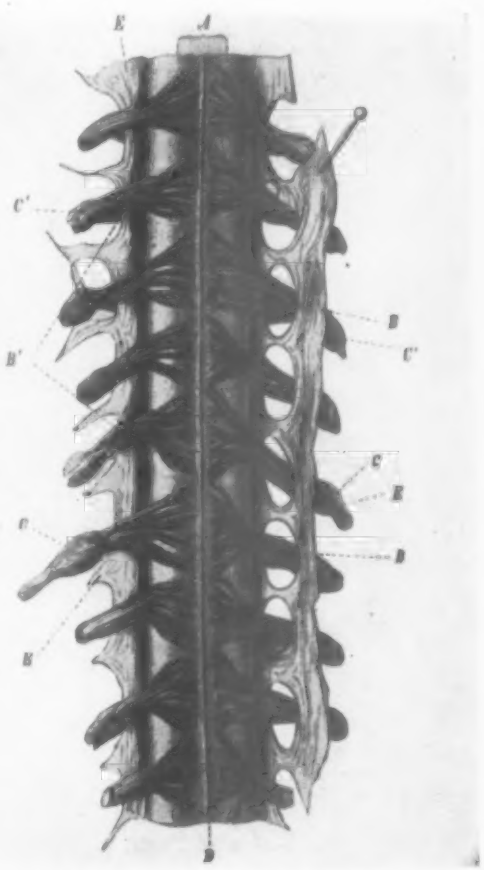

FIG. 3. (A) Spinal cord; (B) anterior, (B^1) posterior nerve roots; (C^1) spinal ganglia; (D) anterior longitudinal groove; (E) dentate ligament, adherent to the dura mater.

The most marked changes are found on the sides of the spinal columns. More or less complete "hooks" are noted on both sides, some being scarcely visible, while others form true "parrot beaks." These always develop in the same direction and are curved. They extend downward if they proceed from the lower angle of a vertebra, or upward if they proceed from the upper angle. Péhu and Daguet[6] think that this is due to calcium infiltration of the lateral

ligaments. If they were new formations they would not be likely to have this constant morphological appearance. The bodies of the vertebrae, as a rule, do not present any marked changes, but the spaces between the vertebrae are found to be narrower and less transparent.

As a whole the roentgen examination usually shows a "ligamentitis." Chronic spondylitis is noted by the fact that at the very onset it is localized at the lumbar or dorso-lumbar segment. It develops from below upward, and it probably chiefly affects the ligaments, as they are gradually infiltrated with calcareous deposits. The first changes in chronic spondylitis begin at the lumbar region and gradually attack the spine in its whole extent.

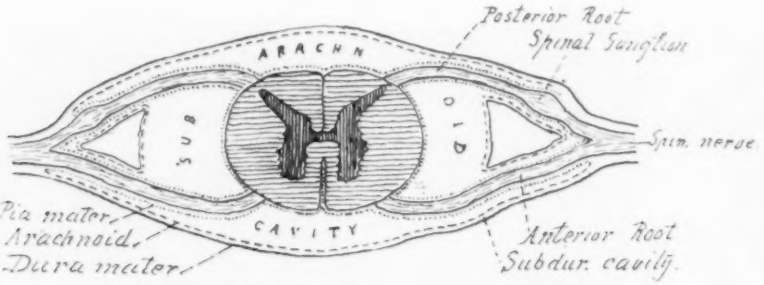

FIG. 4. Spinal cord and nerve roots (Gray).

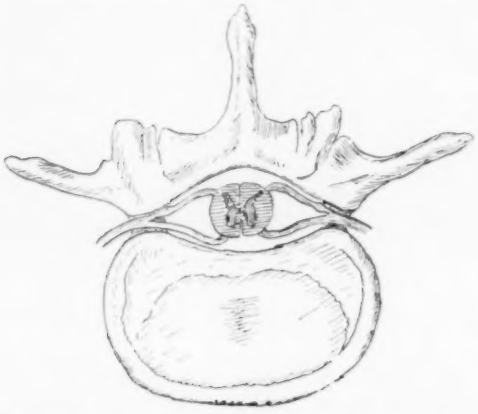

FIG. 5. Foraminal groove of the lumbar vertebrae.

Péhu and Daguet state that they observed a number of cases of spondylitis in the first stages. These patients complained, for various periods of time, of lumbar or lumbosacral pain radiating to the lower extremities in the form of more or less marked sciatica. None of them presented complete union of the spinal column, but definite rigidity or localized pain was noted. On the other hand, they already showed marked changes under the roentgen ray. In some of these they noted one or two "hooks" projecting from an angle of the vertebral body describing an arch upward or downward. This condition was observed only in the lumbar spine.

It is their belief that chronic spondylitis begins in the upper lumbar or lumbo-dorsal region and gradually attacks the spine in its entire extent. This does not mean that there is a rigorous correlation between the functional symptoms and the roentgen-ray appearances. The clinical picture of "soudure" (growing together) of the spine corresponds to symmetrical lateral bulgings, but this may occur without the roentgen ray denoting any changes in the bones. In several cases the cervical spine showed marked ankylosis but the roentgen-ray study showed only a normal picture of this section of the spine.

Frequently the study of the roentgenograms shows no marked pathology although the patients may have suffered for several years, and on the other hand, multiple "parrot beaks," and large bony spurs have been found in individuals who have never suffered from lumbago. Abnormal development of the vertebral processes and anomalous lumbar vertebrae or osteophytic formations, however, do by no means form a grave prognosis.

The presence of pain is evidently due to pressure on the nerve through the vertebral foramen and the application of roentgen

rays is indicated in the early stages. The more advanced the progress of the disease, the more difficult will be the treatment.

Barré and Gunsett treated 20 cases of vertebral arthritis or spondylitis deformans by roentgen rays, 12 of which were completely cured; 5 were greatly benefited; and 3 showed no improvement. They used small doses of 3 to 5 H; 4–5 mm. Al; 25 cm. spark, and repeated the dose every ten days. They were far more successful with the smaller dosages than when the larger treatments were applied. They found that the forms which were most sensitive to the roentgen ray were those in which *pain was the dominant symptom.* Paralysis of the external popliteal nerve in one case disappeared under the treatment. The cases of nerve root inflammation of meningitic nature do not seem to be easily influenced. In cases where the nerve root pain was associated with pyramidal troubles the effect of the roentgen ray was *nil.* Old cases were not so readily influenced as cases of recent date, and some cases did not show any improvement under roentgen-ray treatment. However, this might be more favorably affected by larger doses if applied with prudence.

It is difficult to explain the curative action of the roentgen ray in such cases. It is certain that the osseous lesions are not affected by the treatment and the normal bone tissue cannot be restored. But while the osteophytes are the primary lesion in such cases they apparently play no part in the causation of pain.

It is the secondary lesion, *the extension of the inflammatory process to the intervertebral foramina which is the seat of the pain.* We must assume, therefore, that the roentgen ray acts on the connective

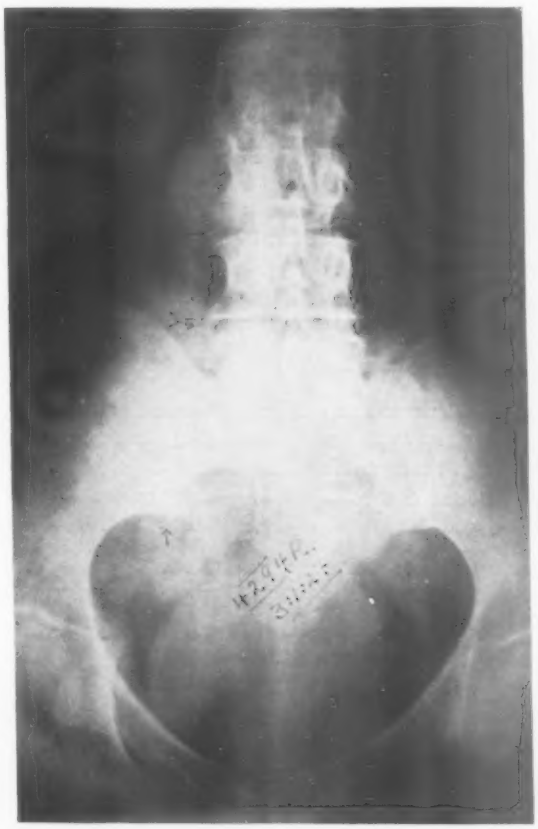

FIG. 6. Marked calcification of the right lumbar vertebrae.

FIG. 7. Foraminal groove at the twelfth dorsal and lumbar vertebrae.

tissue surrounding the nerve in the intervertebral foramen reducing the inflammation and swelling, thus relieving the pressure on the nerve. But whatever is the action of the roentgen ray in these conditions, there is no doubt that a large number of these cases are amenable to roentgen treatment, especially if the treatment is applied early. When an inflammatory focus exists and the radiosensitive cells are destroyed by the roentgen ray, decompression takes place and the pain disappears. The younger the cells, the more easily are they influenced by roentgen rays.

Case I. A. A., physician, aged sixty-four, employed in one of the Government departments at Washington. For many years he had been troubled with attacks of lumbago which had become more frequent during the last few years. During the summer of 1919 he had experienced a severe attack which was treated by rest and the usual applications. When he resumed his office duties the pain had not entirely disappeared, in fact, the condition had developed into a chronic backache which gradually increased in severity. The pain was more marked whenever he was seated and it increased toward evening. Walking seemed to relieve the pain. The condition, however, became so unbearable that he consulted me in the fall of 1923.

Stereoscopic study of the lumbar vertebrae showed chronic productive arthritic changes along the lower dorsal and lumbar vertebrae. This was quite notable at the second and third intervertebral cartilages and similar processes were noted between the fourth and fifth lumbar vertebrae. Numerous shadows of the lumbar vertebrae showed "parrot beaks," and the lateral exposure demonstrated distinct "parrot beaks" anteriorly.

Diagnosis. Chronic spondylitis deformans.

The dental films showed infected alveolar pockets, suggesting extraction of teeth, which was done.

Roentgen therapy was started and five treatments were applied at intervals of two weeks. Later these intervals were increased to three and four weeks and even longer. The dosage was, 5 ma., 5 min., 4–6 mm. Al, and 6 mm. of leather; 12-in. distance; 9-in. gap.

The improvement was slow but steady. In the beginning the patient could not bend his back and could not lace his shoes, but now he can bend forward as usual and can pick up objects from the ground without any difficulty. The so-called bridle action in the lumbar spine which prevented his lying on his back has entirely disappeared, showing that the treatment has relaxed the tension in the ligaments. Previously he could not sit down for any length of time without suffering severe pain, whereas now he carries on his work without any inconvenience. There is still some stiffness in the lumbar region, and after sitting all day some pain or rather "tiredness," is noted during the evening, but the pain has disappeared.

Case II. T. J. N., housewife, aged sixty-four, referred by Drs. Spire and Macatee for treatment of pain in the back. Suspected sacroiliac pathology or trochanteric bursitis of the right side.

May 15, 1923, while descending the stairs of her home, the patient sustained a severe fall injuring the right thigh and knee which became very painful. She consulted two osteopaths who manipulated the knee, hip and spine without any appreciable benefit. Both stated that she had neuritis which had been caused by the slipping of a small bone in the sacroiliac joint. However, she received no benefit from their treatment.

A few months later while in New York she consulted Dr. George Hamlin because of headache and high blood pressure. The pain in the right hip and thigh had become so severe that she could not walk up or down the steps. She returned to Washington and consulted her physician who reported high blood pressure, hardening of the arteries and neuritis. The pain which had persisted for many months was relieved temporarily by drugs, only to return again. Finally, roentgen-ray examination was suggested on March 1, 1924.

Roentgenographic study of the lumbar spine and pelvis showed chronic, productive osteoarthritis of the right sacroiliac juncture and along the lateral margin of all the lumbar vertebrae. The right hip-joint also showed some osteitic shadows, apparently an infectious productive osteo-arthritis of a rheumatic type. I was convinced that we were dealing with an exceedingly painful ligamentitis associated with pressure along the foramina of the lower dorsal and the entire lumbar vertebrae.

The patient had been bedridden for the last four months and no improvement had been noted although all the usual medicinal remedies had been tried. It was agreed that roentgen-ray treatments should be applied.

On March 7, the patient succeeded in getting to my office by means of a taxi and the assistance of friends. She was suffering so much pain that morphia was administered. Two

roentgen treatments were given, one along the lower dorsal, lumbar vertebrae and sacrum, the other along the right hip. *Dosage:* 5 ma., 10 min., 6 mm. Al and 6 mm. leather; 12-in. distance from target to skin, and 9.5-in. gap. This was repeated two weeks later, on March 18. There had been a very slight improvement. One week later, March 25, she came in feeling fine, had no more pain in the spine or hip but complained of pain along the right popliteal space and right foot. The knee was quite swollen but roentgenographic study showed only soft tissue findings such as we expect in rheumatic arthritis. The study of the foot showed the usual osseous arthritis noted in such cases. A roentgen treatment was given over the popliteal space and foot on April 1. She returned on April 15, free from pain except some stiffness along the hip. The treatment had entirely relieved the neuritis and she had slept soundly for the first time since August, 1923. She expressed gratitude at having been greatly benefited, and though she was experiencing occasional discomfort in the right hip, lower limb and knee, she was not discommoded thereby in any way. She is not well entirely and is still under observation.

Case III. A. H. A., plasterer, aged thirty-eight, referred by Dr. R. L. Spire for treatment of suspected lumbar or sacroiliac pathology. Patient complained of pain on the left side of the sacroiliac juncture for nearly three months, gradually getting worse until he was disabled.

Stereoscopic study of the pelvis and lumbar spine showed the fifth lumbar vertebra compressed on the left side and the left lateral process impinging on the ilium. On the right side, the lateral process was quite low but it did not touch the ilium; the ligamentous shadows were rather clear. Above the left transverse process of the fourth lumbar and between the fourth and fifth lumbar vertebral shadows, chronic productive osteitis was noted. A small osteitic shadow was also observed at the upper border of the left acetabulum, apparently a slight productive osteitis following a trauma of the hip-joint. The supraspinous ligamentous shadows appeared clear, at least it was impossible to demonstrate any calcification.

It was suggested that roentgen treatment be applied with the hope that radiation along the foramina of the spine would relieve the pain. Surgical intervention along the left ligament of the sacroiliac joint was to be reserved as a last resort should roentgen treatment fail.

On March 13, 1924, the usual roentgen-ray dosage was applied along the lumbar spine and sacroiliac areas. This was repeated two weeks later and again on April 12. By this time the patient had improved to such an extent that he was working full time every day. On July 26, 1924, he was still well in every way and there has been no recurrence to date.

Case IV. M. G. M., press-feeder, aged forty-six, referred by Dr. Welburn, September 11, 1923. History of removal of gall-bladder and calculi about two years ago. Pains persisted and kidney colic was suspected. Roentgen study showed no evidence of renal, ureteral nor urinary bladder pathology. Study of the spine showed productive arthritis of the eleventh and twelfth dorsal and first lumbar vertebrae and sacral shadows.

Diagnosis. Chronic spondylitis deformans or productive vertebral rheumatism. The patient had suffered for two years from repeated attacks, quite similar to chronic lumbago and had been unable to work. Finally, she was referred to me as a last resort. She had received three treatments at intervals of ten days by June 19, and had improved so much that the pain had ceased entirely. Within two months from the beginning of the treatment she returned to her office duties and to date there has been no recurrence.

Case V. W. A. K., housewife, aged fifty-one, had been suffering for two years from lumbago of the left hip and sacroiliac area. Osteopaths, chiropractors and physicians failed to relieve the pain. She was referred to me for observation April 16, 1924. Roentgen study showed slight relaxation of the left sacroiliac juncture and osteitis shadows at the third, fourth and fifth lumbar vertebrae. A thickening or opacity of the left ligaments along the left vertebrae was noted.

Diagnosis. Chronic productive arthritic spondylitis, especially on the left side between the intervertebral spaces of the third, fourth and fifth lumbar vertebrae. Probable chronic vertebral rheumatism. There were no anterior osseous shadows noted.

The diagnosis was accepted, but the patient determined to visit "Bonesetter" Reese and placed herself under his observation, but the result was not encouraging. She returned to me unimproved; in fact, the pain in the left hip and spine had become unbearable.

On June 7, roentgen rays were applied. Within ten days the patient commented on definite improvement. By July 22 she was able to move about without pain and was observing a general sensation of well being that had been absent for many months. She continued to improve and is practically well and performing her usual household duties.

CONCLUSIONS

1. The diagnosis of chronic lumbago or back pain is not yet definitely established.

2. The consideration of the pathology of intervertebral foramina in the presence of marked pain justifies the use of roentgen rays before proceeding to surgical intervention.

3. Roentgen therapy offers a most efficient method for chronic spondylitis deformans or chronic progressive vertebral rheumatism.

4. Early cases are most amenable to roentgen-ray treatment, and comparatively light doses are more successful than heavier bombardment.

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THE PRESENT STATUS OF THE ROENTGEN TREATMENT OF PURPURA HEMORRHAGICA BY IRRADIATION OF THE SPLEEN*

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IN 1920 Stephan[1] first suggested roentgen irradiation of the spleen for the treatment of purpura hemorrhagica, and reported that this procedure had cured two patients who were suffering from a fulminating form of the disease. Following his suggestion we have treated 6 similar cases according to the technique he advised. It is our purpose to report the results obtained in these cases and to present a critical review of the literature concerning the efficacy of this form of treatment as compared with other forms of treatment of the same condition.

The work instituted by Stephan has stimulated a great deal of clinical experimentation in connection with the treatment of various hemorrhagic diseases by irradiation of the spleen. It is beyond the scope of this presentation to enter into those phases of the work that do not deal with hemorrhagic purpura, but for the information of any who may be interested, we have appended a fairly comprehensive bibliography covering the experimental work along the other lines mentioned. The only reports dealing with the treatment of purpura hemorrhagica by irradiation of the spleen are those of Stephan, Bucky and Guggenheimer,[3] Mandelstamm,[4] Grogert,[5] and Cori.[6]

Stephan's experience with the two cases of refractory hemorrhagic diathesis successfully combated early in 1919, by means of deep roentgenotherapy applied to the spleen lead him to state that roentgen irradiation applied in this way rapidly decreases the coagulation time of the blood *in vitro*, and that it seems to have the same effect on the organism as an extensive loss of blood. He thought roentgen rays exerted a specific functional stimulus on the elements of the spleen other than the lymph follicles. The blood platelet count did not seem to be modified. The coagulation time was sometimes

* Read at the Sixth Annual Meeting, Eastern Section, American Roentgen Ray Society, Atlantic City, N. J., Jan. 22–24, 1925.

shortened to one-fourth, even in normals, after irradiation of the spleen. The maximum effect was apparent between the second and fourth hours, then gradually subsided. His conclusions from researches are that the spleen is the central organ of coagulation, and that stimulating its function by roentgen-ray energy must be regarded theoretically as a true physiologic method of arresting venous and parenchymatous hemorrhages. In numerous cases it proved extraordinarily effectual in practice, far surpassing the effect of any medicinal hemostatics.

Bucky and Guggenheimer[3] also reported favorably on the treatment of purpura hemorrhagica by this method. These authors, contrary to Stephan, however, found an increase in the platelet count following stimulative doses of roentgen rays over the spleen.

Mandelstamm[4] reported that he was unable to obtain any benefit in cases of purpura hemorrhagica treated by Stephan's method. Grogert's results seem good,[5] while Cori was disappointed in the effect of Stephan's method.[6]

Before reporting our cases, we wish to place ourselves on record as being doubtful of the validity of Stephan's contention that splenic function can be stimulated by roentgen irradiation directed toward that organ. It is a moot question as to whether roentgen rays are capable of stimulating the function of any organ, and many authors believe that roentgen rays in any dosage are destructive rather that stimulative. While we do not accept this view in general, we are inclined to believe it to apply to the spleen. In view of the present lack of knowledge concerning the function of the spleen, we feel that the other fundamental assumption of Stephan's, that the spleen is the central organ of coagulation is not established, and as we shall show later, is probably untenable.

CASE SUMMARIES

Six cases were treated by small doses of roentgen rays directed over the spleen, the dosage being one-fifth of an erythema dose.

Case I. Girl, aged twelve, chronic purpura hemorrhagica. The patient was considerably improved after the first treatment. She has been symptomatically well over a period of three years but the last follow-up examination one month ago, revealed that the patient is now in a state of chronic purpura hemorrhagica. This patient received five applications.

Case II. Boy, aged fourteen, chronic purpura hemorrhagica. The patient was temporarily improved but died following a cerebral hemorrhage one month after the first treatment. This case received three applications.

Case III. Female, aged twenty-four, chronic intermittent purpura hemorrhagica. She was temporarily improved after first treatment, but very quickly relapsed into her original condition. She received two applications.

Case IV. Female, aged twenty-five, chronic intermittent purpura hemorrhagica. Improved considerably after the first treatment and remained so for about six months and then all of the manifestations of purpura recurred. She received three applications.

Case V. Male, aged forty-seven, chronic continuous purpura hemorrhagica. Improved to a slight degree after treatment. The condition recurred however. He received four applications.

Case VI. Boy, aged five, acute purpura hemorrhagica. Died three days after treatment.

DISCUSSION OF TREATMENT

All patients received one-fifth of an erythema dose of roentgen rays over the spleen. The factors in the technique were: Open field; skin target distance 18 inches; voltage, 120,000; milliamperage, 5; filtered through 5 mm. Al; time, 10 minutes. The treatments were given from ten days to three weeks apart.

Case I was the only one that exhibited any reaction. The patient was extremely toxic for twelve hours following the first irradiation. Subsequent irradiation did not cause any reaction.

The platelet count was considerably increased following irradiation in three of the cases. In the remaining three, there was no change whatever in the count. The platelet count apparently ran parallel with the clinical improvement in only two of the cases.

Four cases out of the group showed clinical improvement after irradiation, but some of the cases received blood transfusions prior to treatment. Hence it is questionable whether or not we are justi-

fied in ascribing the clinical improvement following irradiation entirely to that agent.

DIAGNOSIS

The diagnosis of our 6 cases seems well established. They all fall within the entity known as purpura hemorrhagica, thrombocytopenic purpura, or essential thrombopenia. This disease is characterized by fairly typical history which need not be discussed here, and a hematologic syndrome as follows: (1) reduced numbers of platelets in the circulating blood, at least during the active phases; (2) a concomitant lack of normal retractility of the clot; (3) a prolonged bleeding time; (4) a normal or only slightly delayed clotting time, and (5) a positive tourniquet test for capillary resistance.

COURSE AND PROGNOSIS OF THE DISEASE

The natural history of purpura hemorrhagica as a disease entity is such a variable one that any conclusions regarding the efficacy of any particular form of treatment must perforce be only tentative at best. Until we have compiled and analyzed a large series of well authenticated and carefully studied cases of the disease we cannot even approximate any mortality statistics. We must therefore content ourselves with general statements and impressions gained from personal observation and from the literature. The excellent review of the subject by Minot and Lee,[7] may well serve as our authority for the following abstracted statements:

Patients suffering with purpura hemorrhagica may show evidence of the disease for a few days or a few weeks and then recover without further trouble. In others the disease may recur within a few days, weeks, or even years. Patients suffering from such subsequent attacks may eventually recover entirely. Occasionally the disease may be very mild and disappear in a few days while other cases may be of the fulminating type and terminate fatally in twenty-four hours. In the continuous form of purpura hemorrhagica the blood platelets are continuously below normal, although the clinical manifestations of the disease (petechiae and hemorrhages) may be irregular in their appearance. In chronic continuous purpura hemorrhagica the active hemorrhages and the occurrence of petechiae may be present for months or years and yet the patients may eventually recover. In the intermittent variety of purpura hemorrhagica the platelets are below normal only during phases of active bleeding. The reduction of the platelet count does not always parallel the bleeding, as there may be only slight thrombocytopenia and fairly active bleeding, on the one hand, and marked reduction of the platelets with little or no bleeding, on the other.

We must insist, however, that according to modern conceptions of the disease, there must be a definite reduction of platelets below the normal level, at least during the active stages, to make the diagnosis of any given case acceptable.

It should be stated in this connection that the counting of platelets is no easy procedure to be lightly intrusted to an inexperienced technician or a "new" intern. There are many sources of error, as may be surmised from a glance at the wide range of variance reported by Holloway and Blackford[8] of the Mayo Clinic, in their simultaneous platelet counts on the same specimens of blood taken at the same time and counted in the same way. It is our conviction that to obtain the most reliable results the platelet counts should be done in every case by several different methods and if possible by several independent workers. The diluting fluids used should always be fresh and filtered, and the pipettes and counting chambers scrupulously clean. A control count should be made in every case to determine whether the diluting fluids contain any platelet-like particles which would invalidate the count. In case of wide divergence of results a thin film of blood, stained by a well-made Wright's, may serve to confirm or disprove the impression of an excess or reduction of platelets. In any case the platelet count should be repeated on several successive days. A wide range of normal values exists, from 150,000 up, according to our findings. The difference between results of venous blood platelet

counts and ordinary capillary "finger blood" platelet counts is, in our hands, so slight and so well within the limits of error inherent in the methods that we do not believe that the venous blood need be used.

Similar precautions apply to the other hematologic tests such as bleeding time, coagulation time, clot retraction, etc. For example, unless great care is observed in the collection, reception and handling of the venous blood for testing clotting time very misleading results will be obtained. We believe that a great deal of the newer work concerning the effect of roentgen rays on the blood-clotting processes is open to criticism on this score. One of the best and most conservative reviews of this subject and which seems to us beyond criticism is that of Minot and Spurling.[9] This article, however, concerns itself more with changes in morphology of the blood than coagulation. From the above survey of the natural history of purpura hemorrhagica and of the difficulties inherent in making an accurate clinical hematologic estimate of progress of the disease, it is obvious that assessing the value of therapeutic measures will be even more difficult.

VARIOUS METHODS OF TREATMENT

Tranfusion of whole or citrated homologous human blood has been the best and most widely used method of treatment of this condition in recent years. Indeed so valuable and important is this form of treatment that most of the other methods that have been employed more recently have been supplemented by transfusion. Accordingly it is very difficult in most instances to discriminate between the possible curative action of the transfusion and of the other methods employed. This stricture applies to some of our own cases as well as those of most other authors. The value of transfusion in purpura hemorrhagica has been well reviewed by Larrabee.[10]

Four cases of purpura hemorrhagica were cured by Dixon,[11] who employed intramuscular injection of whole human blood. Gram[12] cured a case by repeated protein shock. Inoki[13] cured two cases by salvarsan injections. Paisseau and Alcheck[14] report favorably on the treatment of purpura hemorrhagica by peptone shock. Perhaps all the above methods have something in common in that all induce protein shock to some extent. Allied to this also is the roentgen-ray treatment which we are now discussing, inasmuch as this too probably induces mild protein shock. (See article of Minot and Spurling above.) In all of these cases which are reported as cured we cannot escape the suspicion that perhaps some of them would have spontaneously recovered. But it cannot be denied that transfusion has been a life-saving procedure in many of them. There is further possibility that if many of these cases were followed up several years later some would be found in a state of latent chronic purpura or even in an active remittent hemorrhagic phase.

Splenectomy was first recommended for the treatment of purpura hemorrhagica in 1916 by Kaznelson[15] who at that time reported the cure of a patient suffering with the disease in a severe form. He has since reported 3 other cases cured by splenectomy and states that the first 3 cases are still well five years later. Following his lead a number of reports of successful splenectomies for this disease were made in the German literature; and more recently in this country. To date, 32 splenectomies have been recorded. Of these patients, 3 died without improvement while the remaining patients are reported as "cured" or greatly improved.

From a critical review of these cases it is obvious that many are not cured. In some a secondary anemia seems to persist months after operation, and in most there seems to be a tendency for the platelets to return to their previous low level soon after operation. It must be admitted, however, that splenectomy marks a distinct advance in the therapy of the disease, although here, too, most of the cases received one or more blood transfusions.

Recently Lemaire and Debaisieux[16] have reported the prompt recovery of a patient suffering with essential thrombocytopenia after mere ligation of the splenic artery.

SUMMARY AND CONCLUSIONS

(1) Six cases of purpura hemorrhagica treated by irradiation of the spleen according to the method proposed by Stephan are reported. Of these 6 cases, 2 are dead and 4 are improved symptomatically but still show evidences of chronic purpura hemorrhagica. None can be classified as "cured."

(2) The natural history of purpura hemorrhagica is reviewed and the results of the more modern forms of treatment are presented and compared.

(3) Our results do not seem to be in any sense noteworthy as indicating that the so-called splenic stimulation by roentgen rays is a permanently valuable method of treating purpura hemorrhagica.

(4) Irradiation of the spleen does seem to be of some temporary value, however, and we have never observed any untoward effects.

(5) In view of the apparent value of splenectomy in this disease, it would seem to us rational that *massive* irradiation of the spleen offers a method of more promise. We have already begun experiments along this line and hope to make a further report concerning our results at some future date.

APPENDIX

The following is an abstract of the literature concerning effects on the blood of splenic irradiation.

Stephan[1] reports several cases of hemorrhage that were benefited by roentgen irradiation of the spleen, 2 of these patients being cases of purpura fulminans.

Case Report: Man, aged forty-five, had purpura fulminans in which a refractory hemorrhagic diathesis was successfully combated early in 1919, by means of deep roentgenotherapy applied to the spleen.

Case Report: Woman, aged forty, had purpura fulminans and reacted similarly to the above patient.

His investigations lead him to state that roentgen irradiation applied to the spleen rapidly decreases the coagulation time of the blood *in vitro*, and increases the amount of coagulating ferment in the blood serum. Irradiation seems to have the same effect on the organism as an extensive loss of blood but lasts longer. Stephan assumes that roentgen rays exert a specific functional stimulus on the elements of the spleen other than the lymph follicles. The blood platelet count does not seem to be modified but the coagulation time is sometimes shortened to one-fourth even in normals after irradiation of the spleen. The maximum was apparent between the second and fourth hours then gradually subsided.

The coagulation accelerating factor or "G.B.F." according to Stephan, is a constant, varying from 1.4 to 1.8. The "G.B.F." increases after venesection and irradiation of the spleen.

In attempting to explain this rise of "G.B.F." Werner[34] states that Stephan concerns himself partly with the lymph follicles, on one hand, and a reticulo-endothelial apparatus on the other. As he could not find after irradiation of lymphomas in other parts of the body an effect analogous to the one mentioned above, he explained the increase of the ferment in the blood after splenic irradiation as an expression of an irritative effect on the function of the reticulo-endothelial apparatus of the spleen. On the basis of these conclusions Stephan comes to an entirely new explanation of the mechanism of blood coagulation according to which the spleen is the central organ of coagulation.

The functional increasing of the reticulo-endothelial apparatus on one hand leads to an enormous overwhelming of the circulation with ferment and on the other hand to an increase of capillary tonus, which later necessarily leads to a cessation of bleeding. Now where dystonia of the capillary system does not rest on a primary disturbance of splenic function, but has arisen from a dysharmony in other blood glands, the tonicity effect of reticulo cell stimulation will be lacking. Therefore, for example in a climacteric bleeding after splenic irradiation, an entirely different effect is to be expected, but not a cessation of the bleeding. Where the splenic tissues are no longer capable of stimulation there ends the effect of stimulation, such as in cachexia and the last stages of hemophilia.

Here also therapeutic irradiation is valueless.

Further Stephan[2] says he could establish interdependence between the function of the spleen and that of the suprarenals, in the sense that a hyperfunction of the suprarenal cortex accompanied a hyperfunction of the spleen such as in erythremia and a decrease of concentration of the ferment in the serum. For practical purposes Stephan recommends his views particularly as a prophylactic measure before operation and especially in hemophilia and icterus. These theoretical conclusions of Stephan did not remain long without contradiction.

Werner quotes Szenes[17] who opposes the view that in splenic irradiation one is dealing with stimulation of the reticuloendothelial apparatus and also that the spleen holds a place as a center of blood coagulation. He found also after irradiation of malignant goiters and lymphoma of the neck, there was acceleration of coagulation and he has explained the acceleration as being due to the accompanying cell damages.

Heineke[18] could establish that after a short latent period following irradiation, there was a damage to the splenic follicles. Szenes[17] noticed after a subcutaneous injection of 40 c.c. of thyroid extract and of 10 c.c. 10 per cent NaCl solution, there was an acceleration of coagulation. It seemed to be a question of increased production of thrombokinase and thromboplastic substances such as result from cell damage. Furthermore, Wöhlisch[19] brings up with proper reasoning the following: That even after extirpation of the spleen blood coagulation takes place, which certainly speaks against the overwhelming rôle of the spleen in coagulation of the blood. Very important arguments against Stephan's views were advanced by Feissly[20] who said that after irradiation of citrated blood *in vitro* he could show acceleration of coagulation, and also after irradiation of the blood in a dissected out jugular vein of a horse. He therefore explained the effect which he obtained as an influence on the cellular elements of the blood in the sense of an autocytozymtherapie and this explains the reason for the first good results following irradiation of the spleen as being due to the excessive blood supply of the organ. In the same sense Kaznelson and St. Lorant[21] viewed the effect of the roentgen rays as protein therapy. They saw after irradiation of any part of the body, for example of the spleen, severe local reactions take place in the disease joints in arthritis chronica progressiva and concluded that it was a question of protein substance which resulted from a destruction of the lymphocytes occurring everywhere in tissues. Therefore, one sees more effect following irradiation of a region rich in lymphocytes such as the abdomen, rather than, for example, after irradiation in the extremities.

Only Ulrich[22] apparently reports results supporting those of Stephan in a definite sense. He feels that one is not dealing with a cell destruction, but with a stimulative effect. He could not find in dark field examinations even after long roentgen-ray application to various organs, particularly to the spleen, any noticeable structural changes of the lymphocytes. But it is to be held against Ulrich that he only examined the blood during and immediately after irradiation, so that he could easily have missed damages coming on later. Even though tests of Stephan's to explain the effect of irradiation of the spleen have been contraindicated by many, the method itself has been well received.

Jurasz[23] also recommends therapeutic and prophylactic irradiation of the spleen and liver. In his group of cases he could show an acceleration of coagulation *in vitro* in 57 per cent of the splenic cases. In irradiation of other parts of the body, he never found any acceleration. There was never at operation a noticeable shortening of the coagulation time and in the later course he could find no advantage. He holds it as superfluous in the normal patient, but regards it as advisable in hemophilia, icterus and patients with increased blood coagulation in order to prevent postoperative cholemic bleeding. In this type of case, there is a functional disturbance of the liver, in the sense of a decreased production of fibrinogen and thrombokinase. F. von der Hütten[24] recommends in carcinoma therapy an irra-

diation of lymphocytes in order to stimulate the protective powers of connective tissue according to the views of Frankel[25] who was the first to recommend the stimulation of glands of internal secretion in conjunction with irradiation of the tumor.

Förster[26] believed that he had cured a few cases of severe peritonitis by the leucocytosis following splenic irradiation. He admits that it is possible that the effect of increased activity of the stimulated recticulum cells of the spleen could be regarded as a ferment effect. In supporting this view he brings in the observation that "leucocytosis absolute" was not demonstrable in all cases of splenic irradiation; but still the lack of it could be explained by a very rapid destruction of the leucocytes and then subsequently stimulating bodies could be produced at the same time which again could carry out a long standing effect.

Kurtzahn[27] treated two cases by irradiation of the spleen in tumors of the adnexa but these cases were also treated by ice bags and styptics. Therefore, the results were doubtful.

E. Vogt[28] obtained good results in 50 per cent of his cases. In this group, Vogt treated 68 cases of uterine bleeding. His work however does not enable one to say whether or not the results were due to the irradiation. In two of puberty hemorrhage, the bleeding could not be stopped. He recommends irradiation of the spleen in doubtful cases, because it does no harm and may do good.

H. Hirsch[29] noticed that after stimulating irradiation of the spleen the menses ceased oftentimes for months. He proposed to undertake the splenic irradiation in profuse ovarian bleeding in the second half of the intermenstrual period in order to hasten the effect.

Wolmerhäuser and Eufinger[30] report 22 cases of gynecological bleeding. The results were good, and permanent in all cases. They recommend splenic irradiation in selected cases when other measures have failed.

L. Nurnberger[31] reports 25 cases in which irradiation of the spleen was attempted. The results were negative in 7 cases.

Eisenberg[32] reports 26 cases of gynecologic bleeding with hemorrhagic diathesis and prophylactic irradiation of the spleen prior to operation. He obtained only 3 positive results. Therefore, he regards the procedure as useless.

Scholten and Voltz[33] report 27 cases of which 20 cases were followed. The results were good. In the cases treated, 10 cases of metrorrhagia had to be re-irradiated and also 9 cases of menorrhagia had to be re-irradiated.

Werner[34] reports 80 cases of gynecological bleeding in which he obtained good results in 50 cases and negative results in 21 cases.

Werner could not duplicate the favorable results of Wolmershäuser[30] and von Scholten. His results are behind those of Nurnburger[31] who reports 10 cases, 8 of which had regulation of the menses for a long time. Werner never had the opportunity of seeing amenorrhea lasting for several months such as the cases reported by Hirsch[29] and others.

TABLE 2 OF WERNER'S[34] ARTICLE

	Ovarian Bleeding		Juvenile Bleeding		Climacteric Bleeding		Myoma Bleeding		Adrexal Disease		Post Abortive		Other Bleeding		Total	
Results	+	−	+	−	+	−	+	−	+	−	+	−	+	−	+	−
H. Interval same but increasing bleeding.	2	3	−	−	−	4°	2°	4	1	0	1	2	−	−	6	13°
P. Polymenorrhea. Short interval bleeding.	−	−	−	−	−	1	−	2	−	−	−	−	−	−	−	3
P.H. Poly hypermenorrhea. Short interval of and excessive bleeding.	3° 5	2 5	1 1	2 2	− −	4 9	1 3	1 7	− 1	1 1	1 2	− 2	1 1	− −	7 13	19° 26

In cases designated by circle (o) the results were very temporary.

Finally he feels that there is no relation between the spleen and menstruation. The polymenorrhea type of uterine bleeding responds best. He never noticed any damage done to the patient.

The appendix thus far is largely an abstract of Werner's paper. The paper was such a good review of the German literature and so well presented, that the article was abstracted in detail.

Zweifel[35] reports 11 cases cured out of 34 cases treated with mild doses of irradiation over the spleen. The hemorrhages were in cases of chlorosis with general debility and in pre-climacteric bleeding.

Von der Hütten[24] could not detect any material influence on hemorrhage at operation in 35 cases with pathologically retarded coagulation time after giving prophylactic treatment with roentgen-ray exposures over the spleen and with exposures over the liver in 15 cases. The operation followed twelve to twenty hours later. His record shows that after brief preliminary lengthening of the coagulation time, the coagulation time was materially shortened. This was most pronounced at the fourth and fifth hours and disappeared by the eighth hour.

Sahler[37] states that uterine bleeding is not so readily helped by irradiation of the spleen. This was explained by Stephan who said the uterine bleeding was of a dyshormonal type, and could not be benefited. The explanation has been considered above.

Scholten and Voltz[33] report 143 cases of uterine hemorrhage treated by irradiation over the spleen and ovaries. They found that some patients respond to small doses and others to larger doses. They also recommend irradiation of the spleen and ovary, as the combined irradiation gives a better result.

In their series they obtained the following:

Good primary results	102 cases or 71 per cent
Negative primary results	41 cases or 29 per cent

End-results nine months later in 135 cases.

Positive results	36 or 26 per cent
Negative results	54 or 40 per cent
Inestimable	45 or 34 per cent

Kurtzahn[27] stated that irradiation prior to operation was only effective in stopping parenchymatous bleeding. To estimate the effect, he induced patients to let him remove a rectangular piece of skin, one by two centimeters, under local anesthesia using care not to cut down to the subcutis. Sponges were weighed before mopping and afterwards, so as to get amount of blood loss, and a stop watch was used during the bleeding time.

Partsch[38] states that prophylactic irradiation of the spleen brought about a decrease in the coagulation time of the blood at operation in only a small fraction of the cases. There is no clear evidence that preoperative irradiation exerted any influence on the course of healing by preventing postoperative hemorrhages and hematomas. The results of irradiation of the spleen are uncertain, and the irradiation is superfluous as a prophylactic from the standpoint of practical surgery. It is to be recommended only for patients with markedly retarded bleeding coagulation time, as in hemophilia and icterus. Partsch[38] preoperatively irradiated the spleen in 40 cases and the liver in 10 cases. Out of the 40 cases, 23 or 57 per cent showed an acceleration of bleeding time *in vitro*. In only 7 cases or 17 per cent was the bleeding time shortened at operation. In another 10 cases irradiated twenty-four hours before operation, the bleeding time was normal before operation in seven cases. In only 4 cases was the bleeding time perceptibly changed during operation. Two cases of the above 10 cases were drained and they drained as usual. The healing time was as usual. Liver irradiation is much more indefinite than irradiation of the spleen. In only 2 cases out of 10 was acceleration of bleeding time caused.

Mauriac[39] urges caution in irradiation of the spleen in tuberculosis.

Manoukhine[40] only, suggests that irradiation of the spleen may be dangerous in cases where the fragility of white cells is high.

Pagniez[41] et al irradiated the spleens of 24 healthy subjects. In 22 cases, the clotting time was shortened to a fourth, and the same acceleration was noted in the time of retraction of the clot. The reduction of the coagulation time began within 15 minutes after the exposure. The maximum effect was noted in the first four hours following the exposure and lasted from four to seven days. Their experiments show that the effect of the irradiation is on the blood itself, rather than on the spleen, because the same

effect was noted by similar exposures of different parts of the body, especially the large vessels. This opinion was confirmed by five experiments with the palm of the hand after blocking the circulation above. There was no reduction of the clotting time at the end of an hour after the circulation was reestablished. They state further that the action occurs *in vivo* and not *in vitro*.

Levy[42] et al demonstrated that irradiation of the neck and knee produces the same result as exposures of the spleen.

Harbinson[43] carried out some experiments on splenic irradiation. His findings were as follows:

The lethal dose of roentgen rays used in the experiments invariably produced a systemic intoxication and resulted in death on the eleventh day following the exposure of rabbits over whose lower abdomen or left hypochondrium it was applied.

Direct irradiation of the spleen with this same lethal dose, however, gave rise to no apparent clinical symptoms. At the end of the eleventh day the rabbits whose spleens were irradiated acted essentially like normal rabbits.

There was a fall in the white blood count characterized by relative lymphocytosis five days after irradiation and a return to an approximately normal differential count five days later. A few Turck's irritation forms were found in one of the rabbits ten days after exposure of its spleen.

The lower blood counts and the increased hemoglobin content of the spleen and liver gave evidence of increased red blood cell destruction. The only findings at autopsy were a pale looking spleen and a large pale liver. The spleen showed no evidence of fibrosis, no areas of caseous necrosis; an early stage of chromatolysis was found, however, as shown in the breaking up of the chromatin material of the large and small lymphocytes with granules of varying size and the absence in many instances of the delicate chromatin threads which normally connect the nuclear lobes of the polymorphous nuclear cells. The chief features of the liver section were the washed-out appearance of the liver cells, the hyperplasia and disintegration of the Kupffer cells and the abnormal hemoglobin content. His experiments gave no evidence of injury to the gastrointestinal canal. The slight amount of degeneration found in the convoluted tubules of the kidney was also found in the controls. This is of importance in the interpretation of the work of Hall and Whipple. The theory that foci of necrosis occurring in the intestinal wall after general irradiation are caused by the elimination of toxin split products seems to be untenable, at least so far as the spleen is concerned. Rather such evidence of injury together with similar upsets produced in the kidney would seem referable to the direct action of the rays.

It seems wise to include some of the techniques used by different investigators, so that the results may be compared with doses given.

von der Hütten[24] used the following:

S. S. Therapie apparatus.	
Coolidge tube	
Skin-target distance	30 cm.
Filter	3 mm. Al
⅓ H. E. D. (Seitz-Wintz)	
Time	5 min.
Parallel spark gap	41 cm.
Voltage about	220 kv.
Milliamperes	2.5
Field	10 × 10 cm.

Wolmersbäuser[30] used the following:

Skin target distance	26 cm.
Filter	3 mm. Al
Müller tube.	
Dose ¼ skin dose.	

Sabler[37] used the following:

Delivered 18 to 20 per cent of skin dose to depth of 10 cm.

Tube target skin distance	23 cm.
Filter	0.5 mm. Zn + 4 mm. Al
Milliamperes	2
Portal	6 × 8 cm.

⅓ H. E. D. (Dose repeated in 4 days)

Scholten and Voltz[33] used the following:

Tube target skin distance	40 cm.
Filter	0.5 mm. Zn + 4 mm. Al
Portal	10 × 15 cm.
Milliamperes	2.0

Delivered ½ to ⅔ of a skin unit.

Vogt[41] used the following:

Skin target distance:	28 cm.
Filter	0.5 mm. Zn + 1.0 mm. Al
Field	10 × 15 cm.

Therapeutic dose ⅓ skin unit.
Prophylactic dose ¼ skin unit.

Stephan[1] used the following:

1. Distance	28 cm.
Milliamperes	2.5
Time	15 minutes
Field	10 × 12 cm.
Dose	⅓ of carcinoma dose

Homogeneous radiation used.

2. Time	7 minutes
Homogeneous ray	13 per cent
Milliamperes	2.5
Distance	30 cm.
Filter	3 mm. Al

½ skin unit = Ca. 250 Fürstenau.

Unfortunately some of the factors are not given in the above techniques, but one gathers from the text that approximately 200 kv. was used by all investigators.

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Publishers: PAUL B. HOEBER, INC., NEW YORK

Issued Monthly. Subscription $10.00 per year, $11.00 in Canada and $12.00 in foreign countries. Advertising rates submitted on application. Editorial office, 1909 Massachusetts Ave., N.W., Washington, D.C. Office of publication, 67-69 East 59th Street, New York.

Information of interest to all readers will be found on page iii. Lists of officers of The American Roentgen Ray Society and The American Radium Society will be found below.

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Publishers: PAUL B. HOEBER, Inc., 67-69 E. 59th St., N. Y. C.

Twenty-sixth Annual Meeting: At Washington, D. C. September 22-25, 1925.

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Seventh Annual Meeting: At Chicago, Illinois.

WESTERN SECTION: H. B. THOMPSON, Chairman, Seattle, Wash., IRVING INGBER, Secretary, San Francisco.

Combined meeting with Pacific Coast Roentgen Ray Society, Hotel Oakland, Oakland, Calif., July 9, 10 and 11, 1925.

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EDITORIALS

INTERNATIONAL CONGRESS OF RADIOLOGY LONDON, JULY 1–4, 1925

THE following American representatives sailed from New York on June 20 to attend the International Congress of Radiology in London. Many of these are accompanied by their wives and other members of their families: Drs. Eastmond, Pfahler, Stewart, Manges, Cole, Kann, Sosman, Ernst, Gladys Carr-Paterson, Pierson, Keal, Sante, Weitzner, Herendeen, Hickey, Lee, Failla, Ray, Bliss, Case, Holmes, LeWald, Imboden, Carman, Christensen, Pearson, May, Erskine, Quick, Pirie, Gerber, Moody, Soiland, George, Law, Butler, Moore, Jaches, and Stevens.

Since titles of papers to be read at the Congress had to be in the hands of the committee by May 1, it is possible to give a preliminary program of the meeting. The program is long and the subjects of the papers inclusive so that all radiologists and allied workers cannot fail to be interested.

The work of the Congress will be divided into three sections, namely, Radiology, Physics, and Electrotherapy and Physiotherapy. In order to get through the large number of papers in the section on Radiology two sessions of this section will probably meet simultaneously, one on diagnosis and one on therapy.

On the opening day the section of Radiology and Physics will hold a joint session for a discussion on the standardization of dosage, which will be opened by Professor Beazy who will discuss the subject from the physical standpoint, and by Dr. Béclère, Paris, who will discuss the subject from the medical standpoint.

On the evening of the opening day the Silvanus Thompson Memorial Lecture will be delivered by the Duc de Broglie of Paris; on the second evening a Congress dinner will be held, and on the third evening Sir Berkley Moynihan will deliver the MacKenzie Davidson Memorial Lecture.

The details of the daily program are still to be made up and will be announced shortly. Meanwhile it may be noted that the section of Electrotherapy and Physiotherapy intends to devote the three sessions respectively to Heliotherapy, probably introduced by Sir Henry Gauvain, to Diathermy, probably introduced by Dr. Cumberbatch, and to some branch of Physiotherapy.

The papers received or promised for the section on Radiology are here listed under a rough subject classification, the full titles being given where they are known.

SECTION ON RADIOLOGY

BONES

1. Dr. A. W. George, Boston. "A Method of Diagnosis of the Injuries of the Atlas and Axis."
2. Dr. W. H. Stewart, New York. "The Time Factor in the Disappearance of Roentgenographic Evidence of Fracture of the Skull."
3. Prof. H. Kienböck, Vienna. "Bone Tumours: Differential Diagnosis by *X*-rays."
4. Dr. A. H. Pirie, Montreal. "Normal Rarities of Bone Simulating Disease."

FOETAL

1. Dr. H. A. Harris, London. "The Embryo and the Foetus in Radiology."
2. Dr. Carlos Heuser, Buenos Aires. "Radiography in the Early Months of Pregnancy."

URINARY

1. Dr. E. H. P. Cave, Harrow. "*X*-ray Examination of the Male Urethra."

ALIMENTARY TRACT

1. Dr. Lewis Gregory Cole, New York. Cinematographic Demonstration.
2. Dr. Charles Eastmond, Brooklyn. "Chronic Infection of the Gastro-intestinal Tract: Its Roentgen Manifestations."
3. Dr. H. M. Imboden, New York. "Intermittent Obstruction of the Small Intestines."
4. Dr. James T. Case, Battle Creek. "Diverticula of the Small Intestine."
5. Dr. R. O. Moody, Dr. W. E. Chamberlain, and Dr. R. S. Van Nuys, Oakland, Calif. "Living Anatomy of the Stomach, Liver and Colon; Results of a Roentgenologic Study of 1,000 Healthy Adults."
6. Dr. H. H. Berg, Frankfort-on-Main. "Direct Signs of Duodenal Ulcer."
7. Dr. N. Ratkoczi, Budapest. "Duodenal Studies."
8. Prof. Gosta Forssell, Stockholm. "Further Observations on the Motor Mechanism of the Mucous Membrane of the Digestive Tract."

9. Sir J. Frank Colyer, London. "Radiology and the Practice of Dental Surgery."
10. Dr. A. E. Barclay, Manchester.
11. Dr. G. Kharmandarin, Kharkow. "On the Roentgenological Diagnosis of Chronic Appendicitis."
12. Dr. de Backer and Dr. Van de Putte, Ghent. "Etude radiologique de la traversée digestive chez le nourrisson normal."

GALL-BLADDER

1. Dr. P. F. Butler, Boston. "Physiology of the Gall-bladder."
2. Dr. Sherwood Moore, St. Louis. "The Development of Cholecystography."
3. Dr. R. D. Carman, Rochester. "Cholecystography: Some Development in Its Application to the Diagnosis of Cholecystic Disease."
4. Dr. L. Bischoff, Lugano. "Contribution to the Study by *X*-rays of the Pathologically Enlarged Gall-bladder."
5. Dr. Karl Herman, Szubotitza. "Radiological Representation of the Gall-bladder after Graham."

RADIUM THERAPY

1. Dr. G. Failla, New York. "A New Method of Intra-tumoral Irradiation."
2. Dr. Douglas Quick, New York. "The Treatment of Carcinoma of the Tongue."
3. Dr. Cordua, Kiel. "The Morphology of the Collum Carcinomata of the Uterus as a Basis for the Judgment of the Sensibility to Rays."
4. Prof. Bayet, Paris. "Radium Surgery."
5. Dr. S. A. Heyerdahl, Oslo. "Actinomycosis Faciei and Colli Treated with Radium."
6. Prof. F. Gudzent, Berlin. "On the Biological and Therapeutic Properties of Small Radioactive Substances."
7. Dr. Robert Coliez and Dr. Lucien Mallet, Paris. "Etude de repartition de l'énergie rayonnanate gamma dans les applications curietherapiques internes."
8. Dr. Lucien Mallet and Dr. Robert Coliez, Paris. "Techniques de curiethérapie profonde."
9. Dr. Precerutti, Turin. "The Various and Practical Therapeutical Applications of Leather Rendered Radiferous."
10. Dr. R. G. Canti and Dr. F. G. Spear, London. "The Effect of Radium on Mitosis in Tissue Culture."
11. Mr. Malcolm Donaldson, London. "A Report on 85 Inoperable Cases of Carcinoma of the Cervix Treated by Radium."
12. Dr. Regaud, Paris. "Sur la curiethérapie des épithéliomas de la langue et des adénopathies cancereuses cervicales."
13. Dr. N. S. Finzi, London. "The Use of Radium in Combination with *X*-rays and Surgery."
14. Mr. W. Sampson Handley, London. "The Encirclement Method of Radium Treatment."
15. Dr. Douglas Harmer, London.
16. Dr. J. Douglas Webster, London.
17. Dr. Neumann, Brussels.
18. Dr. Sluys, Brussels.
19. Dr. Delporte, Brussels.
20. Dr. Lacassagne, Paris.
21. Prof. Proust, Paris.
22. Dr. F. T. Tomanck, Prague. "The Results of Treatment of Pernicious Anemia with Radium."
23. Dr. F. Tomanck, Prague. "The Effects of Prolonged Radiation in Treatment of Leucemia."
24. Dr. de Backer, Ghent. "Radiotherapie et formation de fistule."
25. Prof. Daels, Ghent. "Contribution to the Experimental Provocation of Tumours by Means of Radium."
26. Prof. Daels and Dr. de Backer, Ghent. "Contribution to the Technique of Intraperitoneal Irradiation of Cancer of the Cervix Uteri."
27. Mr. J. Valcke, Ghent. "Contribution a l'etude de la desinfection du cancer due col uteri."

HEART

1. Dr. George W. Holmes, Boston. "Aortic Regurgitation: The Use of the *X*-ray in the Differentiation of Etiological Types."
2. Dr. Robert Knox, London. "Investigation of the Cardiac Movements by the Use of the Slit Diaphragm and the Moving Film."

LUNGS

1. Dr. W. F. Manges, Philadelphia. "Non-opaque Foreign Bodies in the Air Passages and Food Passages."
2. Dr. S. A. Reinberg, Leningrad. "Roentgen-ray Studies on the Physiology and Pathology of the Tracheobronchial Tree."
3. Dr. Jaquerod, Leysin. "The Radiographic Control of the Healing of Tuberculous Lesions of the Lungs."
4. Prof. L. Küpferle, Freiburg. "The Anatomical Analysis of the Roentgen Picture in Phthisis."
5. Dr. Lars Edling, Lund, Sweden. "Roentgen Rays in the Diagnosis of Pulmonary Anthracosis."
6. Dr. Walter Altschul, Prague. "Temporary Relaxation of the Diaphragm."
7. Dr. Woodburn Morison, Manchester. "Diaphragmatic Hernia."
8. Dr. Stanley Melville, London.
9. Dr. A. C. Jordan, London. "Peribronchial Phthisis."
10. Mr. Morriston Davies, North Wales.

ROENTGEN THERAPY

1. Dr. Isaac Gerber, Providence. "The *X*-ray Treatment of Superficial Pyogenic Infections, Particularly of the Skin."
2. Dr. George E. Pfahler, Philadelphia. "The Saturation Method in Roentgen Therapy."
3. Dr. Burton J. Lee, New York. "A Report of a Series of Cases Treated by Radiation and Conservative Surgery. From the Breast Clinic of the Memorial Hospital, New York."
4. Dr. James Ewing, New York. "Tissue Reactions to Radiation."
5. Dr. Edwin C. Ernst and Dr. Montrose T. Burrows, St. Louis. "Studies on the Biological Effect of *X*-rays."
6. Dr. A. W. Erskine, Cedar Rapids, Iowa. "Effective and Economic Filtration."
7. Dr. Ralph H. Herendeen, New York. "Results in the Roentgen-ray Treatment of Medullary Bone Tumours."
8. Dr. S. Fraenkel, Moscow. "Effect on the Cell by Isolated Treatment of the Blood by *X*-rays."
9. Dr. A. Rosselet, Lausanne. "L'Action indirecte en radiothérapie."
10. Prof. M. O. Nemenow, Leningrad. "A Contribution to the Biological Action of Roentgen Rays."
11. Dr. E. H. Zweifel, Munich. "Distant Effect of *X*-ray in Basedow's Disease."
12. Dr. E. H. Zweifel, Munich. "The Stimulating Dose."
13. Dr. F. Tomanck, Prague. "Present and Future of *X*-ray and Radium Therapy."

14. Dr. E. Van Acker, Ghent. "Contribution a l'etude des modifications histologiques consecutive a l'irradiation."
15. Dr. Walter Altschul, Prague. "Critical Discussion of Dosage."
16. Dr. Albert Soiland, Los Angeles. "The Treatment of Cancer of the Breast from the Viewpoint of a Radiologist."
17. Dr. T. S. P. Strangeways and Prof Hopwood, London. "The Effect of *X*-rays on Mitosis in Tissue Culture."

NERVOUS SYSTEM

1. Dr. J. W. Pierson, Baltimore. "The Localisation of Brain Tumours by Ventriculography."
2. Dr. P. M. Hickey, Ann Arbor, Michigan. "*X*-ray Findings in the Epileptic Skull. A Report on 600 Cases."
3. Dr. M. C. Sosman, Boston. "A Consideration of Aneurysms of the Internal Carotid and Tumours at the Base of the Brain."
4. Dr. F. M. Law, New York. "Roentgen Diagnosis of Mastoid Disease."
5. Dr. S. Fraenkel, Moscow. "Encephalography."
6. Prof. A. Schüller, Vienna. "Defects of the Skull."
7. Dr. Jacques Forestier, Aix-Les Bains. "Radiodiagnosis by the Lipiodol Method."

THE MENACE OF THE "ANTIS"

The recent outbreak of smallpox in Washington, D. C. has again brought to public attention the fact that there is still well organized opposition to vaccination. The United States Public Health Service requested the 62,000 employes in the Federal Service to have themselves vaccinated, and although President Coolidge set the example and thousands followed, the response was by no means universal. For many years it has been established beyond the possibility of a doubt that vaccination affords a high degree of protection against smallpox. This is denied only by the ignorant and by those who wilfully blind themselves to the truth.

The Washington epidemic has again demonstrated the value of anti-smallpox vaccination. Of the total number who contracted the disease only four had been vaccinated at all and none of the four had been vaccinated for many years. The infection was a particularly virulent one, the death rate being 35 per cent, but in spite of this no deaths occurred among those who had been vaccinated; all of the deaths, nineteen in number, were among the unvaccinated.

Failure to be vaccinated is usually due to ignorance, and active opposition to it is largely due to the propaganda carried on by faddists and sentimental theorists.

This Journal is concerned with everything that affects medical progress but its special interest is, of course, in the progress of roentgenology and radium therapy. From this latter standpoint the propaganda against vaccination is of interest to us because the anti-vaccinationists are the same people who are opposed to all medical progress along scientific lines. They are the same old crowd of "antis" who pretend to sit in judgment on medical science although profoundly ignorant of its aims, its methods, and its far-reaching beneficial results. It includes not only the anti-vaccinationists but the anti-antitoxinists, and the anti-vivisectionists; its ranks are recruited from that unbalanced portion of society whose actions and beliefs are based on poorly controlled emotions, that portion of society that Roosevelt used to call the "lunatic fringe." If they could have had their way diphtheria would still be taking the lives of children in great numbers as it did before the time of antitoxin; there would be no reliable insulin for the treatment of diabetes, and no serum for the treatment of tetanus.

The roentgenologist is especially interested in the efforts to limit or abolish animal experimentation because much valuable information about the action of the roentgen ray and radium has already been obtained by this means and he hopes for still more valuable results in the future. What the success of the "antis" would mean in this and in every branch of experimental medicine and to humanity in general is indicated by the following quotation from an article entitled "The Danger of Ignorance" in The Outlook for May 13, 1925.

"The total result of the campaign against truth and scientific progress is to alarm the unthinking and insidiously to encourage them to refuse to comply with health precautions. The 'antis' have failed to pass, in Colorado and California, laws which would forbid any kind of experimentation, even the administering of any drug to any animal if it gave him any pain. If this legislation had passed, laboratory medical research would have

stopped and, to quote the pamphlet already referred to (issued by the American Association for Medical Progress in New York City), 'no smallpox vaccine could be made in that State, and unless fresh vaccine could be brought in from outside first the children, and eventually the whole population, would be exposed to one of the most terrifying and deadly scourges known to man. If there were an outbreak of diphtheria in that State, thousands of children would die as they used to die before the days of antitoxin unless relief came from some other State where no such law was in force. The outlook for farm animals would be just as bad. If there were an epidemic of hog cholera, it would be impossible to check it unless hog cholera serum, the only known preventive, could be procured outside the limits of the State.'

"Lately this form of appeal to ignorance has turned from trying to pass State laws to promoting referendum action. The answer is obviously in the spread of enlightenment, and such men as ex-President Eliot, Dr. W. W. Keen, the veteran protagonist of medical advance, and the late Ernest Harold Baynes have through this Society done much to that end.

"Why is it that the United States in 1923 stood third highest among over fifty nations in the number of cases of smallpox, with only India and Russia exceeding its bad record? Why is it that in this country Massachusetts had in that year only one-tenth of one case to every 100,000 of its population, while Montana had one hundred and ten cases to very 100,000? Why is it that the United States and Great Britain had over 32,000 cases of smallpox, while a region in northern Europe of equal area had only 131? The answer of those who know the facts is that the 'case rate of smallpox in any community is a direct index of the degree to which universal vaccination is preached and practiced.'

"One need not be an alarmist because there have been in 1923 and 1925 local increases in smallpox. The only wonder is that they have not been greater in view of the negligence engendered by the propaganda of ignorant fanatics who attack the very bulwarks of modern knowledge. It has been said with a great degree of truth that 'every case of smallpox in this country means a victory of superstition, ignorance, or carelessness.'"

THE LEONARD PRIZE

The American Roentgen Ray Society is again offering the Leonard Prize in 1925, and details appear on advertising page ii of this number of the JOURNAL. The manuscripts submitted for the previous prize were of a high order of merit and covered a variety of subjects pertinent to roentgenology. It is to be hoped that the contestants for the next prize will be equally zealous in their efforts.

Subscribers to THE AMERICAN JOURNAL OF ROENTGENOLOGY AND RADIUM THERAPY *visiting New York City, are invited to make the office of* THE JOURNAL *(69 East 59th Street, New York) their headquarters. Mail, packages or bundles may be addressed in our care. Hotel reservations will gladly be made for those advising us in advance; kindly notify us in detail as to requirements and prices. List of operations in New York hospitals on file in our office daily.*

SOCIETY PROCEEDINGS, CORRESPONDENCE AND NEWS ITEMS

Items for this column solicited promptly after the events to which they refer.

RADIOLOGY

AMERICAN MEDICAL ASSOCIATION

AT the meeting of the American Medical Association held at Atlantic City, May 25–29, 1925, three sessions in the Section on Miscellaneous Topics were devoted to radiology, these sessions meeting at Hotel Breakers on the afternoons of May 27, 28 and 29.

It will be particularly gratifying to radiologists to know that at the meeting of the House of Delegates of the American Medical Association on Tuesday, May 26, a separate section was established to be known as the Section on Radiology.

The following quotation from the minutes of the Atlantic City Session (Journal American Medical Association, May 30, 1925, p. 1660) may be of interest.

A Section on Radiology

"For several years through communications addressed to the Council and through resolutions submitted to the House of Delegates, there has been expressed an insistent demand for the establishment of a Section on Radiology. This demand has been voiced most largely by representative physicians devoting themselves to this especial field of work. It is believed by many that the establishment of a Section on Radiology in the Scientific Assembly of the American Medical Association will go far toward keeping the practice of this specialty in the hands of qualified physicians and will discourage the tendency, which has become marked in some quarters, to have the practice of this specialty dominated by those who are less well qualified. Last year two sessions in the Section on Miscellaneous Topics were devoted entirely to radiology. These were splendidly attended, and the program presented was highly commended. At this annual session, three periods in the Section on Miscellaneous Topics will be given over to this subject.

"The Council has frequently expressed itself as believing that no greater number of sections should be established than now exist, and has encouraged as far as possible the reading of papers on radiologic subjects before the regularly established sections of the Scientific Assembly. But because of the success that attended the sessions held in radiology in the Section on Miscellaneous Topics last year, and because of the enthusiasm and interest of the officers appointed for the sessions to be held this year, as well as because of the importance of the whole field of radiology, the Council on Scientific Assembly recommends to the House of Delegates the establishment of a separate section to be known as the Section on Radiology, and the changing of the By-Laws accordingly."

The first of the sessions on Radiology was called to order on Wednesday afternoon by the chairman, Dr. P. M. Hickey. Dr. Hickey opened the scientific session with an address on the Teaching of Roentgenology. Dr. Hickey's conclusions were that a survey of the medical colleges throughout the country shows that the departments of roentgenology are for the most part entirely inadequate; that roentgenology should be recognized as a separate department in all standard medical schools; that the teaching of roentgenology in the medical schools should be carefully correlated with other specialties; and that Class A hospitals should assist in the teaching of roentgenology.

The section was unusually fortunate in having as its guest Dr. A. E. Barclay, Manchester, England. Dr. Barclay further honored the section by presenting a paper on the "Problem of Malignant Disease from the Radiologist's Side." He stated that the radiologist has the opportunity of looking at the problem of malignancy as a whole because every type of growth is referred to him either for diagnosis or treatment. While radiosensitive growths do respond to irradiation very promptly it is his opinion that the failure to cure or check the disease by this means shows that there is an underlying malignant process giving rise to this overgrowth. This is the *x* or unknown quantity of the cause of malignant disease. Lymphosarcoma is an example of such a malignant disease. It would appear that the unknown cause originates in one type of cell and stimulates other cells of like nature to an unnatural activity. The only cases in which a cure can be hoped for by irradiation are those in which there is a radiosensitive growth with no underlying cause.

The remainder of the Wednesday afternoon session was taken up with a symposium on gastric, duodenal and jejunal peptic ulcer. This subject was presented from various standpoints.

Dr. H. T. Karsner, Cleveland, presented the "Pathology of Peptic Ulcer." He stated that it is now known that throughout the course of peptic ulcer inflammation plays an important part. This progresses from the acute to the chronic state. He stated that peptic ulcer occurs more often in females than in males; that there is no doubt that cancer may develop in the base of a long standing peptic ulcer, and that the incidence of cancer as a sequel to peptic ulcer does not exceed 10 per cent. The speaker also took up in some detail the presumptive existing causes such as faults of secretion, vascular lesions, bacterial causes, neurogenic causes, etc.

The next paper by Dr. R. D. Carman, Rochester, Minn., took up the "Roentgen Diagnosis of Peptic Ulcer." He divides the roentgen signs of gastric ulcer into direct signs and indirect signs. Under direct signs he places the presence of a niche, and the constant deformity of the bulb without a niche. Under the indirect signs come hypertonicity as a common feature in non-obstructive ulcer; hyperperistalsis; hypermotility and gastric retention. Since these secondary signs may be produced by other lesions, no one of these signs alone may be taken as proof that a peptic ulcer exists. The other points covered in the paper were the fundamental requisites for satisfactory examination, the technique, tests of gastrospasm, carcinomatous ulcers, and the concurrence of gastric and duodenal ulcer.

Dr. L. F. Barker, Baltimore, took up the subject of peptic ulcer from the internist's standpoint. He stated that a constitutional predisposition seems to be indicated as a cause but that the true etiology of peptic ulcer is unknown. He covered some of the present-day conceptions of the etiology. While the symptoms persist over a long period, there is no history that is constant for duodenal ulcer. Every patient suspected of ulcer should be subjected to a thorough examination—anamnestic, roentgenographic, chemical and physical; the physical findings being of value in helping to rule out other pathologic conditions. In covering the therapy of peptic ulcer, Dr. Barker stated that most internists now favor the use of more conservative forms of therapy in uncomplicated cases, such as a suitable diet and physical and psychical rest. He favors the use of drugs to a limited extent only.

Dr. J. T. Case, Battle Creek, Mich., presented a paper on "Gastric and Duodenal Roentgen-Ray Findings after Operation." He stated that post-operative studies furnish valuable information. Studies made immediately after the operation; fifteen days after operation; seven months after operation and a few years after operation will show which methods of operation are the best.

Near the close of this session the section was honored by a visit from Dr. Pusey, the retiring president of the American Medical Association, and the new president, Dr. Haggard. Dr. Pusey introduced Dr. Haggard who made a speech of welcome to the section. He said that while he was interested in the other sections he felt toward the Section on Radiology very much the way a father does toward his newest baby.

The first paper on the Thursday afternoon session was presented by Dr. W. S. Newcomet, Philadelphia, on the "Control of Nonmalignant Uterine Hemorrhage by Radiation." The aim of his method of treatment is to give a dose of radiation sufficient to control the bleeding without destroying the natural menstrual bleeding. This cannot be done in every case and the cessation, especially in women near the menopause is likely to be permanent. The roentgen ray is preferred to radium in these conditions, and the dose used is so mild as to cause no perceptible change in the skin over the pelvis. If a mild dose does not control the condition a heavy radiation will also fail. Out of a series of 60 cases only 3 have failed to respond to treatment.

Dr. B. J. Lee, New York, reported the "Results of Radium Therapy for Recurrent Carcinoma of the Breast." This report included 363 cases of recurrent carcinoma admitted to Memorial Hospital Breast Clinic up to December 31, 1921. A large number of interesting statistics were given in this paper. In a tabulation giving the regions in which metastases occur, it was shown that most often the first recurrence

is in the supraclavicular region. Both radium and roentgen rays were used alone or in combination, the kind of radiation employed being determined by the individual case. It is believed that preoperative and postoperative cycles of roentgen rays are important means against recurrence.

The next paper was by Drs. T. A. Groover, A. C. Christie, and E. A. Merritt, Washington, D. C., on the "Roentgen-Ray Diagnosis and Treatment of Thymoma." While this is a comparatively rare condition the incidence is probably greater than is supposed. The diagnosis is based on the roentgen-ray findings which are fairly characteristic; namely, a thin, flat mass spreading in all directions from the anterior mediastinum, hugging closely the anterior thoracic wall and preserving a more or less circular contour. Two typical cases were reported. The response to radiation treatment was prompt.

Dr. H. P. Doub, Detroit, presented a paper on "Immediate Metabolic Effects following Deep Roentgen-Ray Therapy: Prevention and Treatment of Untoward Reactions." This was a continuation of work previously reported in this Journal. The protection of the organism against the acute reaction following deep roentgen-ray therapy was referred to in the speaker's first paper only as supporting the hypothesis of salt action on the cells. The present study includes clinical application and experimental work on dogs to determine how far the protection can be carried.

Dr. F. M. Hodges, Richmond, reported work on the "Roentgen Ray in the Treatment of Local Inflammations, Cellulitis and Carbuncles." In the case of carbuncles, if the lesion is small and can be excised removal is probably the method of choice. However, in the majority of cases the roentgen ray appears to act as a specific and excellent results have been obtained in the treatment of 17 cases. The chronic infections of the parotid usually respond well to this treatment, and roentgen radiation is probably of value in the early stage of erysipelas.

In discussing this paper, Dr. Golden, Dr. Trostler and Dr. Gray reported good results from the roentgen-ray treatment of carbuncles.

"Thymus and the Treatment of its Hyperfunction: Clinical and Roentgenologic Considerations" was the title of the paper presented by Dr. E. C. Samuel, New Orleans. In a study of 623 children aged one to three years, 125 cases of thymic enlargement were found. The diagnosis is based upon both the roentgenologic and clinical findings. While roentgen rays and radium have both been used in the treatment of thymic enlargement, roentgen radiation is the treatment of choice. The technique used in radium radiation is 100 mg. through 3 mm. brass filter, distance 5 cm., held in place by adhesive plaster; 8 to 12 hr. exposure, interval between applications between twelve days and two weeks. Three applications with no improvement has been the limit.

The technique used in roentgen radiation is 7 in. gap, 5 ma., time 1 min., through 1 mm. Al, 10 in. distance, 0.1 skin erythema dose, 4 or 5 exposures.

The concluding session of the Section on Radiology was held on Friday afternoon. The first paper in this session was by Dr. Isaac Gerber, Providence, and had to do with the roentgen-ray treatment of bronchial asthma and chronic bronchitis. He stated that the work was not presented with the intention of bringing forth a new idea but rather to place fresh emphasis upon a field of radiation treatment that has been rather neglected in this country. Dr. Gerber uses two methods of treatment in asthma: (1) The direct method, which is the older one and consists of applying the rays directly to the thorax and its contained organs. This treatment probably has its effect through a shrinking action of the rays on the enlarged tracheobronchial and mediastinal glands, and (2) the indirect method, in which the rays are applied to other organs, generally the spleen. Just how an effect is obtained from this method is not quite clear. The theory is that certain antibodies may be released which modify the anaphylactic condition. The direct method is probably the method of choice. In many cases of asthma the amount of sputum is reduced and the number of paroxysms lessened.

Chronic bronchitis can also frequently be helped by applications of roentgen rays to the mediastinum.

Dr. B. H. Nicholas, Cleveland, presented a paper on the "Kidney Stone as a Diagnostic Problem." In 164 cases of kidney stone, pain was the predominating symptom, being present in 86 per cent. In a study of the kinds of salts present in kidney stones, it was found to be the calcium salt which brings out the shadow on the roentgenogram. The phosphatic calculi are the ones most often missed. A description of a new method of localizing kidney stones was given.

Dr. E. S. Blaine, Chicago, contributed a paper on "Manipulative Dislocations of the Atlas." This was a report of 4 cases of dislocation caused by "chiropractic adjustment." These adjustments had been given for so-called "luxation" of the cervical spine. It appears from the evidence at hand that this result of chiropractic treatment is not infrequent and probably occurs many times without competent medical investigation.

Dr. J. D. Camp, Boston, reported on the "Sella Turcica and the Significance of Changes in Its Roentgenographic Appearance." The observations based on anatomic specimens and roentgenograms show the normal sella turcica to vary in contour and size. The variations in contour were classed into three types, the round, the oval and the flat, of which the oval type was found to predominate in the adult (58 per cent of the specimens studied were of the oval type). The average sella will measure 1.06 cm., and 0.81 cm. in the anteroposterior and the vertical directions, respectively. Variations in the shape of the clinoid processes are numerous, and union between the anterior, middle and posterior clinoids, producing a "bridged sella" occurs in about 5 per cent of cases. Such an anatomical variation seems to be of no clinical significance. Pseudo-defects and apparent anomalies of structure are easily produced in a roentgenogram by faulty localizing technique. Pathologic conditions producing changes in the sella are numerous and a differentiation of these changes as to cause is often difficult. Owing to the characteristic deformity of the sella usually produced by each, the differentiation between an intrasellar and extrasellar lesion in generally possible.

A paper by Dr. W. F. Henderson, Jackson, Miss., had to do with "Further Observations on Antiperistalsis in the Duodenum." Antiperistalsis may be considered evidence of a pathologic condition, usually of the obstructive or inflammatory type. A large series of cases observed by the author manifesting antiperistalsis in the duodenum have exhibited hookworm infection as the only cause of the pathologic condition.

In a paper on "Deep Roentgen-ray Exposures as an Aid in the Differential Diagnosis of Mediastinal Tumors," Dr. W. A. Evans, Detroit, brought out the fact that the most common malignant growths of the mediastinum are those originating in the lymph glands; others originate in the thymus and thyroid gland. These tumors are easily affected by radiation. Benign tumors of the mediastinum are uninfluenced by radiation thus furnishing a method of differential diagnosis. Roentgen examinations should be made at ten days, three weeks, six weeks and two months following exposures.

Dr. L. R. Whitaker, Boston, reported on "Further Experiences with Cholecystography." He has used sodium tetraiodophenolphthalein by both the intravenous and the oral methods of administration. The intravenous method was used on 60 patients in 8 per cent of whom a reaction occurred which, however, was not severe enough to do harm. The diagnosis was correct in 93 per cent as against 70 per cent by clinical methods. For oral administration a stearic acid coated pill has been used (one pill contains 5 gr. of the tetraiodo). The number of pills given depends on the size of the patient. While the oral method of administration is not quite so reliable as the intravenous method the advantages are that it is more convenient, can be used in ambulatory patients, and by this method it is possible to rule out a large proportion of cases of supposed gall-bladder disease.

The officers appointed for the Section on Radiology for the coming year were as follows: A. C. Christie, M.D., Wash-

ington, D. C., chairman; H. M. Imboden, M.D., New York City, Vice-chairman; M. J. Hubeny, M.D., Chicago, secretary; A. C. Christie, W. F. Manges, and P. M. Hickey, executive committee.

Ruth Bigelow.

TENTH ANNUAL MEETING AMERICAN RADIUM SOCIETY

The American Radium Society held its Tenth Annual Meeting at Haddon Hall, Atlantic City, N. J., on May 25 and 26, 1925. Dr. William S. Newcomet, president of the Society, called the meeting to order. After a business session the scientific program was taken up.

The opening paper, "Radium Radiation from a General Utility Standpoint," was presented by Dr. Albert Soiland, Los Angeles. This was a general review of a few of the conditions in which radium is of benefit, particularly in the oral cavity and in many skin conditions. The discussion of the value of radium was prompted by a statement alleged to have been made by the chief of staff of the London Cancer Hospital to the effect that "This Hospital has more radium than any other institution in the world. We have discontinued the use of it entirely in the treatment of cancer because in our opinion it lowers the resistance of the tissues to the invasion of growth." The correctness of this quotation is being investigated.

The four remaining papers in the Monday morning session concerned themselves with the use of radium in carcinoma of the cervix uteri, the corpus uteri and the ovaries.

In a paper on the "Use of Radium in Inoperable Carcinoma of the Cervix," Dr. C. D. Brooks, Detroit, stated that the two most common types of carcinoma of the cervix uteri are squamous cell and adenocarcinoma. He classes as inoperable those with severe sacral pain; with cancerous extension from the cervical mucosa to the vaginal mucosa; with fixation of the uterus in the cul de sac; with involvement of the rectum; marked cachexia and known metastases.

He applies from 50 to 100 mg. radium in a Universal applicator in the cervical canal, the average treatment being from 2400 to 4000 mg-hr. The best method, it was found, is to apply the radium as above and repeat in three days, with a third dose in some cases—all given within the first ten days, and followed by deep roentgen-ray therapy.

Of 100 cases treated, 18 are well after one year; 11 are well after two years; 3 are well after three years, and the remainder are dead or lost track of.

Dr. William P. Healy, New York, presented a paper on "Carcinoma of the Cervix; Evaluation of Treatment with Radium." From a study of 1173 cases of cancer of the uterine cervix admitted to Memorial Hospital from 1915 to 1925, it is concluded that radium is the best single therapeutic agent for this condition. The technique worked out by Bailey in 1917—cross-fire internally and externally with radium—was used until 1922 when the external use of low voltage roentgen rays was substituted for the external radium application. The dose of radium is 6000 to 9000 mc-hr. given within three days. Two to four weeks is allowed to elapse before the low voltage roentgen therapy is given. In the low voltage therapy, the author claims to obtain a 24 per cent skin erythema dose at 10 cm. below the surface.

With regard to hysterectomy in conjunction with irradiation, Dr. Healy stated that in a number of cases where this operation had been performed following irradiation and a section of tissue examined, no evidence of cancer was found, showing that the operation was unnecessary. In cases with recurrence of the growth, an operation was of little avail. In some favorable cases, the results after a hysterectomy followed by radium and low voltage roentgen-ray therapy have been satisfactory.

In a discussion of this paper Dr. Leda Stacy said that the results at the Mayo Clinic coincided with those of Dr. Healy; that is, when irradiation was given and the growth was absorbed, there was no need for subsequent hysterectomy, whereas when irradiation was not successful, a hysterectomy did not add to the comfort of the patient nor to the length of life. In

closing the discussion, Dr. Healy said it was the unfortunate fact that there is no early symptom in either cancer of the cervix uteri or corpus uteri. Bleeding is the only symptom and that appears only when the condition is comparatively far advanced. This was shown by the fact that out of 6 cases applying for treatment one month after onset of bleeding, only 2 could be termed early cases.

Dr. Henry Schmitz, Chicago, followed this with a paper on "Carcinoma of the Ovaries: Its Treatment with Radium, Surgery and X-rays." The principal fact brought out in this paper and discussion was that the condition is primarily a surgical one; that the detection of an ovarian enlargement makes an exploratory laparotomy imperative, and that if the condition is not amenable to operation some degree of palliation may be hoped for from radium or roentgen rays.

Dr. J. A. Corscaden, New York, brought out the fact that fibromyomas may be treated surgically by various kinds of excision, and radiologically by radium or roentgen rays, given in sterilizing or non-sterilizing doses. The bleeding can be stopped by any one of these methods. In his experience, the partial dose of roentgen ray or radium has been productive of an enormous amount of mental disturbance incident to the establishment of an artificial menopause. He stated also that in his opinion a normal pregnancy could not be expected after radium or roentgen irradiation.

In discussing this paper, Dr. Case stated that at the Battle Creek Sanitarium 40 per cent of cases of fibromyoma undergo surgery and 60 per cent radiation therapy. In patients under thirty-eight years of age radiation is not used because of the psychic disturbance; radium is also contra-indicated where a latent salpingitis is known to exist.

Dr. Schmitz stated it to be his firm belief that a fibromyoma always remains a fibromyoma and does not undergo malignant degeneration.

At the opening of the Monday afternoon session, Dr. Emil Beck, Chicago, again emphasized the value of a sutureless operation for malignancy, with the necessity for efficient postoperative irradiation. This paper was illustrated by lantern slides showing results in typical cases.

Dr. L. R. Taussig, San Francisco, spoke on the "Limitations of Radium Therapy in Dermatology." He covered briefly the benign conditions such as birth-marks and vascular nevi in which good results may be obtained with radium; others, such as pigmented nevi and certain kinds of warts contraindicate the use of radium; or if this method of treatment is used but is not followed at once by good results, some other treatment should be substituted. As to the malignant conditions, the same statements apply.

The principal points brought out were that while radium is a therapeutic agent of considerable value in dermatoses, benign and malignant, it has its dangers and limitations. Especially, treatment with it should never be continued indefinitely, but should be supplemented by other means. Dr. Taussig believes that extensive carcinomas or sarcomas should not be treated by irradiation alone, since bad results frequently follow and bring the use of radium and roentgen rays into disrepute among the laity.

Dr. Maurice Sittenfield, New York, presented some experimental work on the biological effects of radium upon tissues growing *in vitro*. Small fragments of chick embryo heart were used. These were planted into suitable media. The amounts of radium used varied from 0.1 to 1.0 mc. In some cases the media were irradiated before the implantation of the tissue and in others the irradiation was carried out after implantation. Suitable controls were also run.

The results of this experiment were that 79 out of 100 cultures lost the power to grow (in 49 there was complete absence of cell proliferation and cell migration and in 30 there was marked inhibition). The 21 remaining cultures seemed to show at first an activity almost equal to the controls, but lost the power to grow upon subculture.

Out of 138 controls, 129 showed normal growth which persisted upon future transplants.

Dr. G. Failla, New York, reported some preliminary work on the differential action

of beta radiation. The object of this work was to determine what he calls the "susceptibility ratio." The fruit fly was chosen as the test object. The sterilizing dose and the lethal dose for these flies was to be determined for the beta and gamma rays of radium and the hard and soft rays of roentgen rays. So far these doses have been found for only the beta rays of radium. Failla found that with beta rays the sterilizing dose is only 1/12 that of the lethal dose. All the conditons of the experiment remained the same except length of exposure. With the gamma rays he has been unable to kill the flies with the amount of radium available, up to 10,000 mc-hr. The experiments so far would seem to indicate that there is a variation in the susceptibility ratio with the type and quality of radiation. If this is so the radiologist would be justified in trying different types of radiation in order to find the correct one.

Dr. C. H. Viol, Pittsburgh, spoke on an ever important subject, that of protection to technical assistants and those handling large amounts of radium. He urged upon the employer the acquiring of suitable instruments for protection and upon technical assistants the employment of these instruments. He gave a lantern demonstration showing the different methods of protection used in the laboratories of the Radium Emanation Corporation.

Dr. A. C. Heublein, Hartford, Conn., gave a preliminary report on the use of an absorbable filter with bare tubes of radium emanation. He said that while both radium element needles and bare tubes have their advantages and disadvantages, it would seem that bare tubes would be more advantageous if the necrosis following their introduction could be prevented. He has therefore been using a bismuth paste, employing a special needle and syringe to surround the tubes with the paste. After the insertion of the needles into the lesion the bismuth is supposed to be slowly absorbed by the tissues. Much more work will have to be done along this line before final proof of the value of the method is available. Dr. Failla stated that experiments were being made with very thin gold emanation tubes which seemed to him to be better than the use of the bismuth paste.

The scientific session on Tuesday morning opened with a paper by Dr. A. L. Dean, New York, on the "Treatment of Epithelioma of the Penis with Radium and Roentgen Rays." The method described was based on the treatment of 56 cases of this condition in the Department of Urology of Memorial Hospital, with 5 additional cases from the radium service of Dr. Quick. There has been a more satisfactory regression of the primary condition with radium than with roentgen rays. The average treatment has consisted of 65 mc-hr. radium emanation per sq. cm. of tumor surface, filtered through 0.5 mm. silver. If the tumor is deep, this is followed by local amputation, and irradiation of the inguinal region with high voltage roentgen rays whether metastases are present or not. The results show that this method of treatment is more satisfactory than treatment by operation alone.

The next paper was by Dr. E. L. Keyes, New York, on the "Influence of Radium Treatment upon the Prognosis of Malignant Tumors of the Testicle." These tumors are usually teratomas which are composed largely of embryonal tissue and thus respond quickly to irradiation. On the other hand, early diagnosis is difficult, and the tumors are very malignant making any course of treatment palliative for the most part. The impression gained from this paper and discussion was that although irradiation may be of value in causing regression it does not cause cure in advanced cases. More is to be hoped for by an early diagnosis.

Dr. R. E. Loucks, Detroit, spoke on "Thyroid Gland Diseases with Radium Treatment in Thyrotoxicosis." This was in the main a rather general review of hyperthyroidism. Of over 300 cases of hyperthyroidism treated during the last four years, 5 advanced cases died soon after treatment; 2 others have had a relapse. If the heart symptoms persist for some little time after treatment Dr. Loucks finds 1.5 min. of Donovan's solution of more value than Lugol's solution.

Dr. O. L. Norsworthy, Houston, Texas, described a practical instrument for inserting needles of radium salt to any desired depth. This particular instrument was devised because the insertion of seeds causes trauma, it is often difficult to place them properly and to keep them in the desired position. Not being satisfied with any of the instruments for the insertion of radium needles, the speaker devised an instrument which he believes obviates his objections to other instruments.

The first four papers of the Tuesday afternoon session made up a symposium on the treatment of intraoral malignant disease. The first in the series was presented by Dr. G. W. Grier, Pittsburgh, and had to do with the treatment of intraoral carcinoma by contact application of radium. The author claimed as the advantages of his method of treatment the absence of sloughing and less danger of exciting metastases. The cases which illustrated the method of treatment were hopeless cases, but he believes that contact applications in these conditions offer just as good hope of treatment without unpleasant complications.

Dr. F. E. Simpson, Chicago, described the treatment of intraoral conditions with radium emanation. He stated that both the primary lesion and the lymph nodes in the neck should be treated. His conclusions were that radium emanation is of great value in intraoral cancer.

Dr. B. F. Schreiner, Buffalo, contributed a paper on the "Results Obtained in Epithelioma of the Tongue Treated by Radium and X-rays." This was a statistical study of 127 cases treated at the Institute for Malignant Disease. The cases were divided into two groups: Group I consisting of lesions confined to the tongue or immediately adjacent tissues, and Group II, consisting of patients with lesions on the tongue or adjacent tissues with definite metastases at the time of admission. The results in Group I show that in 16 out of 46 cases the lesions have been healed by radium implantation for periods up to four years. The results in the further advanced cases in Group II have shown the treatment to be only palliative.

Dr. Maurice E. Lenz, New York, reported on "Curie Therapy of Epidermoid Carcinoma of the Mouth as Carried out at the Radium Institute, Paris." A number of techniques have been tried out at the Institute, but recently a combined filtered interstitial and external Curie-therapy has been instituted which appears to be better than any method so far used. He emphasized the importance of sterilizing an infected lesion or clearing up the intraoral cavity before proceeding with radium treatment. The disease should be arrested at the first treatment if success is to be attained.

The session concluded with a paper by Dr. J. T. Case, Battle Creek, who presented a method for irradiating rectosigmoid carcinoma. He advised the use of this method only in conjunction with and as soon as possible after colostomy.

This brief summary is intended to bring out only a few of the important points presented. The papers in full will be published in succeeding numbers of this Journal.

The meetings were well attended and all of the communications were followed by interesting discussions. Dr. Douglas Quick of New York was installed as president. The other officers elected were as follows: Albert Soiland, M.D., Los Angeles, president-elect; B. F. Schreiner, M.D., Buffalo, first vice-president; G. W. Grier, M.D., Pittsburgh, second vice-president; S. M. Withers, M.D., Denver, treasurer; E. C. Ernst, M.D., St. Louis, Secretary.

Ruth Bigelow.

ANNUAL MEETING

CHICAGO ROENTGEN SOCIETY

The Chicago Roentgen Society held its annual meeting at the Virginia Hotel on May 8, 1925. Papers were read by Dr. Wm. C. MacCarty, Rochester, Minn., on the "Pathology of Bone Tumors," and by Dr. Emil Beck, Chicago, on "Sarcoma Treated as a Superficial Lesion."

The following officers were elected for the ensuing year: E. L. Jenkinson, M.D., president; I. S. Trostler, M.D., vice-president; E. S. Blaine, M.D., secretary-treasurer.

THE ANNUAL MEETING

WASHINGTON, D. C., SEPT. 22–25, 1925

Notwithstanding the many meetings of interest to roentgenologists, the interest which is being manifested in the forthcoming Washington meeting of the American Roentgen Ray Society is highly gratifying.

The response to the questionnaire sent to the membership in March with respect to their contemplated attendance has been generous. Many have offered to contribute to the program, and a number of helpful suggestions have been received. It may be of interest to note that about two-thirds of the papers so far listed for presentation deal with diagnostic problems. The subjects covered are diversified and indicate increasing interest in clinical roentgenology. The program is not yet filled, and those desiring to participate are urged to send in the title of their contribution at once. Do not neglect to send in an abstract of your paper not to exceed 200 words. The constitution of the American Roentgen Ray Society provides that this be done. It will of course entail a little additional work, but it is believed that a strict adherence to this provision of the constitution will add materially to the success of the meeting.

It is also urged that those presenting papers elect someone to open the discussion and that he be furnished a copy of the paper at least two weeks prior to the meeting. The advantages of doing this are too obvious to require comment.

Do not delay making hotel reservations. Write direct to the Mayflower Hotel, Washington, D. C.

Thomas A. Groover,
President-elect.

MEETINGS OF ROENTGEN SOCIETIES

We contemplate the publication of a list of roentgen society meetings such as that below, in each issue of the Journal, gradually adding other home and foreign societies as the information reaches us. Secretaries of societies not here listed are requested to send the necessary information to the editor.

NEW YORK ROENTGEN SOCIETY
Secretary, Dr. Eugene V. Powell, 217 East 42d St.
Meets monthly on second Monday, New York Academy of Medicine.

THE CANADIAN RADIOLOGICAL SOCIETY
Secretary, Dr. E. C. Brooks, Montreal.
Annual meeting, Regina, Sask., June 22–26, 1925.

ROENTGEN RAY SOCIETY OF CENTRAL PENNSYLVANIA
Secretary, Dr. W. E. Reiley, Clearfield, Penna.
Two meetings a year, April and October.

THE NEW ENGLAND ROENTGEN RAY SOCIETY
Secretary, Dr. Frank E. Wheatley, 520 Beacon St., Boston, Mass.
Meets monthly on third Friday, Boston Medical Library.

PHILADELPHIA ROENTGEN RAY SOCIETY
Secretary, Dr. Eugene Pendergrass, University of Pennsylvania, Philadelphia.
Meets monthly on first Thursday evening, Pennsylvania Hospital

CHICAGO ROENTGEN SOCIETY
Secretary, Dr. Edward S. Blaine, 2005 S. Wabash Ave.
Meets monthly on second Friday from October to May (except during month of December) at Virginia Hotel. Dinner at 6 P.M., scientific session at 8 P.M.

PACIFIC COAST ROENTGEN RAY SOCIETY
Secretary, Dr. R. G. Van Nuys, San Francisco.
Two meetings a year.
Coming meeting at Hotel Oakland, Oakland, Calif., July 9, 10 and 11, 1925.

CLEVELAND RADIOLOGICAL SOCIETY
Secretary, Dr. E. P. McNamee.
Meetings are held at 6 o'clock at the University Club, on the fourth Monday evening of each month from September to April, inclusive.

CENTRAL ILLINOIS RADIOLOGICAL SOCIETY
Secretary, Dr. C. J. McCullough, Decatur, Illinois.
Regular meetings held quarterly.

SOCIETA ITALIANA RADIOLOGIA MEDICA
Secretary, Professor M. Ponzio, University of Torino, Torino.

THE BRITISH RÖNTGEN SOCIETY
Meets on the first Tuesday of each month from November to June inclusive, at 8.15 P.M., at the British Institute of Radiology, 32 Welbeck St., London, W. 1.

ELECTRO-THERAPEUTIC SECTION OF THE ROYAL SOCIETY OF MEDICINE (CONFINED TO MEDICAL MEMBERS)
Meets on the third Friday of each month during the winter at 8.30 P.M. at the Royal Society of Medcine, 1 Wimpole St., London, W. 1.

BRITISH INSTITUTE OF RADIOLOGY
Secretary, Dr. John Muir, 32 Welbeck St., London, W. 1.
Meets at 32 Welbeck St., but regular dates and times of meeting have not yet been arranged.

SCANDINAVIAN ROENTGEN SOCIETIES
The Scandinavian roentgen societies have formed a joint association called the Northern Association for Medical Radiology, meeting every second year in the different countries belonging to the Association. Each of the following societies meets every second month except in the summertime:

Society of Medical Radiology of Sweden
Meets in Stockholm.
Society of Medical Radiology of Norway
Meets in Oslo.
Society of Medical Radiology of Denmark
Meets in Copenhagen.
Society of Medical Radiology of Finland
Meets in Helsingfors.

DUTCH SOCIETY OF ELECTROLOGY AND ROENTGENOLOGY
Meets in Amsterdam every second month except in the summertime.

CANCER OF THE LIP

To the Editor:

Dr. Bloodgood's letter on "Cancer of the Lip" published in The American Journal of Roentgenology and Radium Therapy, January, 1925, is an admirable exposition of a surgeon's viewpoint on the treatment of this condition. One would naturally expect a surgeon to have such opinions regarding any pathological condition which can be treated surgically.

However, as in many other questions, there are two sides to this one. The writer's experience is not as extensive as that of Dr. Bloodgood, but it covers a period of twenty years during which time about 100 cases of cancer of the lip have been treated with roentgen rays or radium. These cases would all fall under "Class 5—The lesion is distinctly cancer."

The writer was present at a meeting in St. Louis in May, 1922, where Dr. G. E. Pfahler of Philadelphia read a paper on the treatment of cancer of the lip. His statistics were attacked by Dr. Bloodgood on the ground that no sections were made of the lesions treated and that microscopic examination of all specimens removed in his own cases proved that 60 per cent of all lip lesions were benign. This statement is explained when one reads the classification of lip lesions as published in Dr. Bloodgood's letter. Classes 1, 2 and 4, and probably a good percentage of Class 3, could not by any stretch of the imagination be called cancer. I think it is safe to assume that a report of cases of *cancer* of the lip made by a reputable radiotherapist will not include any of these classes. To remove a section from a cancerous lesion of the lip for study is unwise and dangerous as it greatly increases the chances of metastasis. If these cases are to be treated at all without radical operation, one must accept a clinical diagnosis or challenge the honesty of the radiologist. After all is said and done, the cases which are distinctly cancerous are usually easily recognized and when borderline cases are present they may be classified as such. Fissures, vesicles, warts, keratoses, and leucoplakias all demand appropriate treatment, but I see no reason at all to include such lesions in a consideration of cancer of the lip.

The fallacy underlying Dr. Bloodgood's criticism is that he is comparing good surgery with poor or ill-advised radiotherapy. The truth of the matter is that the results from first class radiotherapy are about the same as from first class surgery. However, the surgeon sees only the small percentage in which radiation fails and who go to him subsequently because of that failure. These are usually the very worst cases of course. On the other hand, the radiologist sees the surgical failures and these likewise are usually the hopeless cases. In the writer's series of cases over half of the failures were in cases which had been previously operated upon. The facts presented in the opening paragraph of Dr. Bloodgood's letter have been duplicated in our practice many times with the single exception that the previous treatment was operation and not radium. Regarding radium treatment the writer believes that the introduction of radium needles into a cancerous lip may excite metastasis in the same manner as the excision of a specimen for examination, and that where it is used it should be applied in contact with the lesion and not thrust into the tissues.

The incidence of metastasis to the cervical lymphatics according to Dr. Bloodgood is about 25 per cent in those cases where the lesion on the lip is unquestionably cancerous. This seems to agree very well with the statistics from other clinics. Half of this number remain well after block dissection of the neck. It would be interesting to know what proportion of the recoveries had well marked palpable glands before operation. It has been the writer's experience that where the glands were noticeably enlarged, say the size of

a chestnut or larger, operation has usually acted as a stimulant to growth and has been quickly followed by recurrence and more rapid progress than before. The percentage of mortality from cervical metastasis appears to be about 12.5 per cent in Dr. Bloodgood's clinic. It is doubtful if this is much better than the results obtained by first class radiotherapy alone. Lesions on the lip are in a very conspicuous location and cause the patient a great deal of inconvenience and for these reasons he usually applies early for treatment. It is unusual to find palpable lymph nodes in the neck when the patient first applies for treatment. If at that time he is given adequate roentgen or radium treatment over the neck, preferably deep roentgen therapy, followed by proper irradiation of the primary lesion, the percentage of cures will be just as high as those mentioned by Dr. Bloodgood. If the primary lesion is subjected to any traumatizing procedure such as caustics, incomplete operation, or insertion of radium needles and this is followed by metastasis to the cervical lymphatics, the chances of cure by any method are very poor.

Of the fifteen failures in the writer's series of cases, nine had been operated upon previously and had recurred, one had been cauterized, two treated by radium insertion, three had had no previous treatment. Of these fifteen cases, six had incurable metastases to the cervical glands and of these six, five had been operated on for the primary lesion.

Pittsburgh, Penna. George W. Grier.
May 5, 1925.

WARNING AGAINST FRAUD

The following letter has been received from Dr. Otho B. Ross of Charlotte, N. C.:

"I am inclosing check for $10.00 for subscription to the 'Journal' from January, 1925 to January, 1926. This payment has been delayed for the reason given below.

"On January 6, a check was made payable to your Company, and given to———, who claimed to be your representative, and that securing subscriptions would help him to work his way through school. It was only recently that we found that he had endorsed the check and cashed it at a local drug store and our bank had received it as a proper endorsement. Your continued statements caused us to look into the matter."

This is a warning to subscribers and others that no money should be paid to agents for subscriptions to this Journal. All remittances should be made direct to the publishers of the American Journal of Roentgenology and Radium Therapy.

DEPARTMENT OF TECHNIQUE

Department Editor: DAVID R. BOWEN, M.D., Pennsylvania Hospital, Philadelphia, Pa.

In this department will be published from time to time, as material is available, suggestions for improvement in technique.

VOLTAGE FACTORS CHART

BY SANFORD WITHERS, M.D.

DENVER, COLORADO

THIS chart gives no *new* data but represents an attempt to present the existing factors in regard to high voltage currents, in a compact and handy form for quick reference.

What effect does altitude or lowered air density have on the sparking distance between points or 12.5 cm. spheres and what are the correction factors at altitudes from 1000 to 10,000 feet?

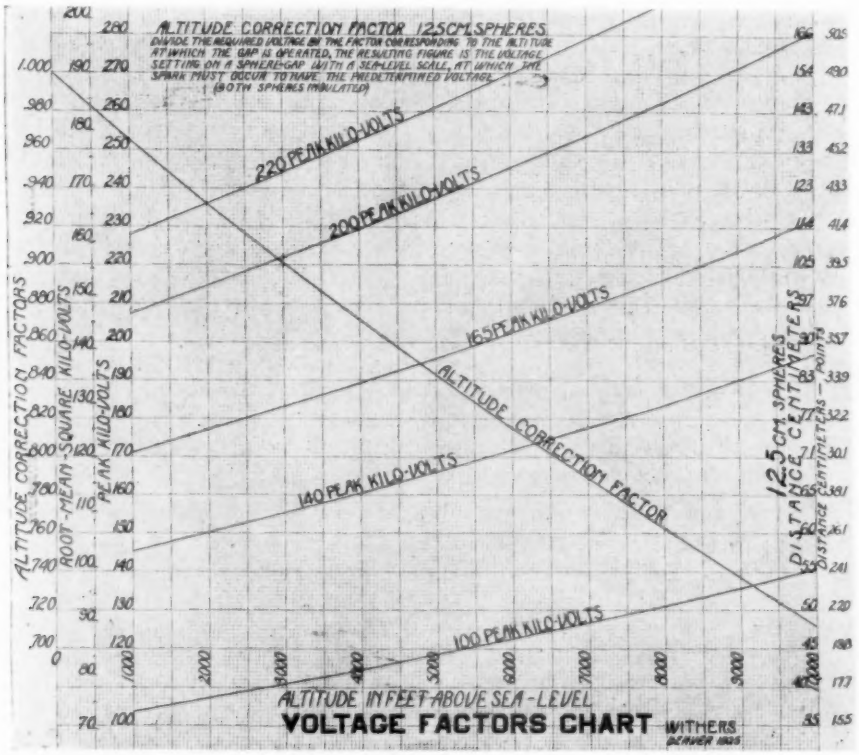
ALTITUDE CORRECTION FACTOR 12.5 CM. SPHERES
DIVIDE THE REQUIRED VOLTAGE BY THE FACTOR CORRESPONDING TO THE ALTITUDE AT WHICH THE GAP IS OPERATED, THE RESULTING FIGURE IS THE VOLTAGE SETTING ON A SPHERE-GAP WITH A SEA-LEVEL SCALE, AT WHICH THE SPARK MUST OCCUR TO HAVE THE PREDETERMINED VOLTAGE
(BOTH SPHERES INSULATED)
220 PEAK KILO-VOLTS
200 PEAK KILO-VOLTS
165 PEAK KILO-VOLTS
140 PEAK KILO-VOLTS
100 PEAK KILO-VOLTS
ALTITUDE CORRECTION FACTOR
ALTITUDE CORRECTION FACTORS
ROOT-MEAN-SQUARE KILO-VOLTS
PEAK KILO-VOLTS
DISTANCE IN CENTIMETERS
12.5 CM. SPHERES
DISTANCE IN INCHES — POINTS
ALTITUDE IN FEET ABOVE SEA-LEVEL
VOLTAGE FACTORS CHART
WITHERS
DENVER 1935

FIG. 1.

It answers the following questions at a glance:

Given a sparking distance between points or spheres (insulated); What is the peak voltage? The root mean square (effective) voltage?

What distance should a given effective or peak voltage jump between points or 12.5 cm. spheres?

If a given spark gap has been calibrated at sea-level (all spark-gaps *are* calibrated at sea-level unless otherwise specified) what should be the spark-gap setting to obtain a given voltage at an altitude of X feet above sea-level?

What effective or root-mean-square voltage is equivalent to X peak volts, and vice versa?

With a little study the accompanying chart explains the above questions.

The curves represent the average of values found in various authoritative works such as "The Hand book of The American Institute of Electrical Engineers;" "Peaks Dialectric Phenomena in High Voltage;" tables supplied by the Kelley-Keott Manufacturing Company; the Victor X-Ray Corporation; the Wappler Electric Company; the University of Colorado, Department of Physics and certain measurements and calculations made by the writer.

In some instances, notably in regard to the sparking distances between points and spheres the data of the authorities varied so much that it was necessary to plot "average" curves on large section paper; and from these curves read off the data given in the columns on the right. These columns (on the right) give the sparking distances between insulated points and 12.5 cm. spheres for peak voltage from 100,000 to 280,000 volts, and can be interpolated into root-mean-square (effective) kilovolts by following the coordinates to the middle column on the left.

The first column on the left designated, "altitude correction factors" really gives the correction for variations in air density. In view of the fact that there may be a fluctuation in air density (barometric pressure, etc.) of as much as plus or minus 6 per cent, it is advisable to take this factor into consideration when calibrating a deep therapy equipment. At 1000 feet above sea level, there is a correction of about 4 per cent and at one mile high (Denver) the correction is about 20 per cent in addition to the plus or minus 6 per cent variation mentioned above.

The five most common voltages used in giving roentgen treatment have been plotted accurately on the chart, namely: 100, 140, 165, 200 and 220 kv.

I have had the opportunity of seeing many roentgen-ray installations operating at 3000 feet altitude (and above) and it is my impression that very few of these operators take cognizance of the fact that 200 kv. (actual) requires an operating voltage of 220 kv. at 3000 feet altitude, and about 240 kv. at one mile high. I know therefore that many men are misleading themselves and possibly others on this particular point to which I wish to direct particular attention.

BOOK REVIEWS

Books Received Are Acknowledged under Heading: Books Received. This must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

THE PRINCIPLES AND PRACTICE OF ROENTGEN THERAPY. By I. Seth Hirsch, M.D. Director, X-Ray Departments, Bellevue and Allied Hospitals. With Dosage Formulae and Dosage Table. By Guido Holzknecht, M.D. Professor of Roentgenology, University of Vienna. Cloth. Price, $15.00. Pp. 359, with 300 illustrations and 57 tables. New York: American X-Ray Publishing Company, 1925.

This book is a complete consideration of the general principles of roentgenotherapy. It includes a description of the various types of machines and methods of measuring their outputs; detailed information about the several types of tubes used in roentgenotherapy; elaborate descriptions and diagrams of the different tube holding devices, treatment tables and couches; floor plans of roentgen departments and directions for proper installation of apparatus; a chapter on protective measures, extensive consideration of the physics of the roentgen ray; description of the various methods of measurement; thorough treatment of the subject of dosage both from a physical and a biological standpoint; a discussion of cancer and the effects of irradiation upon it; detailed directions, illustrated by many charts and diagrams, for the treatment of malignant disease; advice in the use of the different types of iso charts; a general discussion of the clinical effects of radiation on the various tissues and organs; and the book closes with two chapters on Holzknecht's Dosage System.

The description of apparatus and its proper installation is concise and yet very complete. It includes the German machines in use to a limited extent in this country, and all of the well-known American machines. The physics of irradiation as applied to therapy is treated in a very comprehensive manner but so clearly as to be readily grasped. The most interesting parts of the book to the practical roentgenologist are those devoted to clinical considerations. Much excellent advice will be found there on the preparation of the patient for roentgenotherapy, his after-treatment, the prognosis in various conditions, and a detailed discussion of the effects of the roentgen ray upon the skin, blood, glandular organs, bone marrow, abdominal viscera, endocrine and nervous systems, musculature, connective tissue and bones.

The book is undoubtedly the best American textbook for the student of roentgenotherapy and because of its charts, tables and other data it will be found a valuable reference book for experienced roentgenologists.

A. C. C.

PRECANCER. By C. Stajano, Montevideo.

This monograph, which is written in French, is a valuable contribution from a member of the surgical faculty of the University of Montevideo, Uruguay, South America. The author attempts, from a detailed study of various precancerous conditions, to deduce some of the underlying causes which lead to the development of these lesions and therefore later to cancer itself. *Chronic localized irritation* has long been known as one of the common factors in the production of cancer. The author goes back still further and studies the reasons why cancer develops in the site of some chronic irritations and not in others. Also he has attempted to find out why cancer develops in regions where there is no irritative lesion or any history of trauma. Vulvar carcinoma is an example of the latter type of tumor.

Stajano believes that irritation merely localizes the neoplasm provided it is aided by other factors which he calls the "terrain cancereuse." He believes that this basis or "terrain" is the result of an alteration of nutrition due to disturbances in nervous control. There are certain regional trophic nerve centers which control cellular multiplication throughout the body. The moment a tissue finds itself deprived of the necessary trophic control so that it cannot maintain a proper balance of cell formation and disintegration, then a neoplastic cell is permitted to germinate. In this one spot, the beginning of a true cancer is thus on the way.

In working out his theories Stajano uses a combination of literary review, experimental observation, and intensive clinical analysis. He first reviews very carefully all the literature on the physiopathology of traumatism including actinic and chemical types of traumatism. He shows how peripheral injuries to a nerve will result in degenerative changes in centrally seated nerve cells a long distance away from the site of the original injury. The amount of damage will depend upon the intensity of injury, the distance of the nerve center, and the time of duration of the traumatism. He shows that there are regions which are predisposed to cancer and others that are not. He explains this on the

basis of nerve supply. Organs which are contiguous to great sympathetic plexuses and other sources of innervation are more susceptible to cancer. Examples are the stomach, the uterus and the breast. On the other hand those organs which are at a distance from the nerve supplies, such as the arms and legs, are less likely to develop cancer.

In his experimental work Stajano has attempted to go somewhat further than the Japanese investigators. Recently a number of the latter have produced true superficial epitheliomata by the use of tar products. They produced ulcers which were continuously irritated and finally developed true malignancy. These investigators were concerned only with the production of epithelioma. Stajano was interested in the mechanism of development of the precancerous lesions themselves. He also used rabbits but did not treat the ears as the Japanese did. Instead he used the costal region. Here he could easily trace out the intercostal nerve with its spinal ganglia and the entire spinal segment. After necropsy he made special preparations of the subcutaneous tissues with the nerve terminations, the intercostal nerve, the ganglion, and the spinal cord. He used control healthy rabbits as well. As a result of his experiments, which continued over a period of many months, he found definite parenchymatous neuritis extending from the site of local repeated irritation with the tar products. There was evidence of a definite ascending degeneration of the nerve. There were degenerations and reparative changes visible in the nerve centers. All these lesions were definite and constant. No changes could be seen in these regions for many months. In fact, tumors did not develop until the fifth month. This is quite different from the experience of the Japanese who did their work on the ears. Stajano believes that the ears are very susceptible because they are closer to the nerve supply. In the costal region there is much greater distance. We have the same problem here as exists with regard to the relative frequency of cancer of the stomach as compared to its rarity in the duodenum and ileum. The trophism or nervous control of cell nutrition is not the function of a special neuron but is the result of a complex function of several special interacting nerve centers.

Another large section of the book is devoted to a very detailed clinical study of certain well known types of cancer. For example, he traces the stages of ulceration of the lip through various levels. First there is an acute ulcer, then a chronic ulcer; eventually a leucoplakia develops and finally a true epithelioma. He notes that under many conditions the development of the lesion would stop at one or another of the benign types without developing into malignancy. These are really all successive steps of the same process. He believes that the earlier ulcers and leucoplakias are of true nervous origin. This is the type of carcinoma which develops where there is a true chronic irritation or traumatism. On the other hand, vulvar cancer is the type which develops under conditions where there is no question of preexisting trauma or chronic irritation. This type of cancer practically always occurs in women at or near the menopause, or in young people where there is clinical evidence of marked ovarian insufficiency. Here also he was able to trace a series of dystrophic states. There is first vulvar pruritus, then cornification with leucoplakia formation, chronic eczema, kraurosis, and finally true epithelial carcinoma. The pruritus is a nutritional disturbance of the nerve terminations in the zone where the tissue is undergoing a disturbed nutrition.

In the study of the causes of disturbed nutrition here, he believes that traumatism is not a factor but that there are other factors which by working together tend to produce the same results, that is a lowering of the functional activity of the nerve centers. These common causes are age, menopause, repeated pregnancy or prolonged lactation which diminishes ovarian activity, infections such as syphilis, tuberculosis, septicemia, etc., extreme emotional and irritating states which activate the endocrine glands, general glandular disturbances, and finally heredity. On the basis of his clinical observations Stajano feels that the functional tone of every tissue is the reflection of the functional state of its controlling nerve centers.

Stajano believes that there is certainly always a precancerous phase to every cancer, although the precancerous stage is often not recognized in those conditions particularly where the factors of chronic irritation and traumatism are either very slight or entirely absent. The production of these precancerous lesions Stajano believes is under the control of the nervous system entirely and the production of the lesions is the reflection of a lowering of the functional condition of the controlling nerve centers. The attack upon cancer in the future therefore means not merely to prevent chronic irritation and traumatism, but to prevent the intrinsic and extrinsic causes of lowering of the trophic condition of the various controlling nerve centers.

The entire book is certainly a very interesting contribution to the study of cancer. The clinical study of the various types of neoplasm is

intensely detailed, with a clinical analysis that is praiseworthy. Unfortunately the book is rather verbose in places, and there is too much repetition of the same group of clinical facts. Also a large portion of the exposition is rather hostile and argumentative in places. This book points the way to a new line of important investigation for the future, and is well worth reading by every radiologist who is interested in some of the deeper aspects of the development of cancer.

ISAAC GERBER.

INTERNATIONAL ABSTRACTS OF ROENTGEN AND RADIUM LITERATURE

ROENTGEN DIAGNOSIS

BEYE, HOWARD L. Errors in the *x*-ray diagnosis of osteogenic sarcoma. *Ann. Surg., Phila.*, November, 1924, lxxx, 730–738.

The value of the roentgen findings in the diagnosis of bone lesions has been overemphasized. The roentgenogram is undoubtedly the most important single finding except the histological picture of the pathological tissue itself but must always be studied in relation to all other clinical data obtainable. The roentgen findings in any group of bone lesions are not specific. In certain cases of osteogenic sarcoma the roentgenogram is so distinctive as to be definitely diagnostic; in others, the roentgen findings may simulate those of pyogenic osteomyelitis so closely that a differential diagnosis between these two conditions is not possible from the plate alone. Pyogenic and syphilitic osteomyelitis and carcinomatous metastases to bone may intimately resemble osteogenic sarcoma.

The primary tumor in the case of undoubted bone sarcoma will sometimes respond to active roentgen therapy in a surprising manner. Experience may show that the results from this form of treatment are better than from the mutilating treatment by amputation. In cases inoperable because of location or extent of the primary growth the treatment should be by roentgen ray or radium and it is inadvisable in such a case to make an incision for pathological diagnosis.

Two cases are reported in which the diagnosis was largely arrived at by roentgen-ray findings and in which this diagnosis seemed to be substantiated by the reaction of the bone lesions to roentgen therapy. Each case came to autopsy and the roentgen diagnoses were demonstrated to be in error. The first case was in a boy aged seventeen. The history and physical findings in the chest were strongly suggestive of tuberculosis and the condition in the shoulder was thought to be tuberculous arthritis. The roentgenogram of the joint showed no pathology except a proliferative lesion of the upper end of the humerus involving the periosteum. The picture was strikingly that of an osteogenic sarcoma. The lesion reacted to roentgen therapy in a spectacular manner and the symptoms began to disappear, while the roentgenogram showed the periosteal new bone of the humerus melting away. The development of gross changes in the lung suggesting metastases seemed to absolutely establish the diagnosis of osteogenic sarcoma. The later finding of tubercle bacilli in the sputum was disturbing, however. Autopsy showed that the lesion was evidently an unusual one of tuberculosis stimulating the periosteum to bone production. If an autopsy had not been held, this would have been considered an undoubted case of osteogenic sarcoma cured by roentgen therapy.

The second case was in a girl aged fourteen. The positive lung findings and the presence of acid fast bacilli in the urine and the history of tuberculosis in an aunt suggested strongly tuberculosis. The local condition was also strongly suggestive of tuberculosis in the history of its onset and its physical findings, while the relatively afebrile course spoke against an active tuberculous joint condition of the hip. The roentgen picture was not characteristic of a tuberculous hip disease because of the extent of the pathological process involving practically the bone from the hip to the shaft, the latter in the region of the trochanters being markedly disintegrated. A subacute pyogenic infection of the femur had to be considered principally because of the roentgen findings. In spite of the local evidence, however, of an active destructive process of the bone, no abscess in the soft tissues could be made out and pus was not found by aspiration. The striking symptomatic and pathological response to roentgen therapy was not to be expected of a pyogenic bone infection.

In this case the presumptive diagnosis of osteogenic sarcoma was made practically by exclusion and this diagnosis seemed to be confirmed by the early relief obtained by roentgen therapy, no other treatment being used. The swelling and induration in the region of the hip subsided and the roentgen ray seemed to demonstrate a beginning healing of the pathological process in the bone. If this patient had gone on to complete recovery the diagnosis of osteogenic sarcoma would have been apparently established but autopsy revealed no evidence of neoplasm and the bone involvement was found to be not tuberculous. The post mortem findings were those of a pyogenic osteomyelitis of the femur.

BLOODGOOD, JOSEPH C. Bone Tumors. Myxoma. Second paper with report of three new cases. *Ann. Surg., Phila.*, December, 1924, lxxx, 817–833.

The first case was a central myxoma of the upper part of the shaft of the femur extending

to the greater trochanter, in a man aged forty-nine. Palpation and the roentgenogram showed a definite central lesion about the size of a hen's egg occupying the greater trochanter and extending to the shaft. The outer bone shell was thin but the shaft of the femur and the greater trochanter were only partially invaded. This was originally diagnosed as a bone cyst, but the history of intense pain should have suggested myxoma, chondroma or possibly sarcoma. The roentgenogram of the recurrence thirteen months after the first operation showed essentially the same picture except that the size was larger. There was no marked destruction of the shaft, and there was nothing in any of the roentgenograms to distinguish the type of the tumor. Thermal cautery by means of soldering irons has been resorted to for more than a year at intervals of about three to six weeks. In this case both thermal cautery and deep roentgen treatment have failed to check or destroy the local growth of the recurrent central myxoma. No signs of metastasis to the lungs have yet appeared. This case confirms previous conclusions on myxoma, namely, its strong tendency to local recurrence.

The second case was a central myxoma of the lower end of the femur involving the shaft and the epiphysis in a woman aged thirty-seven. The roentgenogram showed a central light area involving the shaft and epiphysis. The age of the patient is against bone cyst and the involvement of the shaft as well as the epiphysis is against the diagnosis of giant cell tumor. There was also evident cortical destruction with a soft-part tumor shadow outside the cortical layer; and in addition, there was practically no expansion. This roentgen finding should be looked upon as diagnostic of malignant tumor and shows that pure myxoma may give the same roentgen picture as central myxosarcoma or chondrosarcoma. Intensive deep roentgen therapy gave no improvement. The leg was amputated and the patient has remained well nine months after operation without metastases to the chest. Microscopically the tumor is pure myxoma.

The third case is that of a central myxoma of the lower end of the femur, observed by Dr. Rockey. This case was treated by curetting with hot soldering irons and has remained apparently well for nine months. The roentgenograms before and after operation were compared; the chief difference observed was that the cavity or light area in the lower end of the femur and epiphysis was more distinctly outlined in the picture taken after operation. The roentgenogram taken before operation shows a break in the cortical layer at the junction of epiphysis and shaft just beneath the patella. The cavity which contained the tumor and which was burned out by soldering irons still remains unossified.

EISENDRATH, DANIEL N. Uretero-pyelography. *Ann. Surg., Phila.*, November, 1924, lxxx, 712–715.

As a diagnostic procedure uretero-pyelography may be considered a safe and necessary procedure just as much as ureteral catheterization or lavage of the renal pelvis in urologic management. All that is necessary is a standardized technique of injection and ordinary care in the management of the patient. Uretero-pyelography should never be employed in cases of acute renal infection or in a cystitis so severe that even ureteral catheterization is a menace. In the latter class much valuable information can be obtained as to the condition of the upper urinary tract by studying the question of ureteral reflux in the cystogram.

In the preparation of the patient special stress should be laid upon the necessity of abstaining from ingestion of food and much liquid for six hours before use of the 12.5 per cent sodium iodide solution. Even sterile water injected into the renal pelvis of some individuals will cause reflex nausea, vomiting and even symptoms of collapse, and these will be greatly decreased if the alimentary tract is empty.

The solution should be at the temperature of the body and should be injected slowly and with but little pressure. First the contents of the renal pelvis are aspirated and then 7 to 10 cc. of solution is injected through a ureteral catheter whenever possible as high as the renal pelvis. If the patient does not complain of pain and there is no resistance it is safe to continue injection of more solution, until there is distinct pressure or until 50 to 60 cc. have been injected. The first roentgenogram is then taken while the catheter is inserted either into the renal pelvis or up to the level of an obstruction in the ureter. The catheter is then withdrawn until it lies near the lower end of the ureter, and a second exposure made after injecting solution until the resistance is again encountered. The third exposure is made about an hour after the first to ascertain the occurrence of any retention in the renal pelvis or ureter such as is seen in ureteral stricture. If there is no suspicion of a movable kidney, the patient must also be examined in the vertical position as well as the horizontal before the catheter is withdrawn to determine the degree of mobility of the kidney and any kinking of the ureter. If possible, all of the

solution should be permitted to escape before the ureteral catheter is withdrawn.

FAY, TEMPLE. The diagnostic value and interpretation of cerebro-spinal determinations. *Ann. Surg., Phila.*, November, 1924, lxxx, 641–651.

Much of value may be obtained by spinal, cisternal and ventricular puncture. These operations should always be undertaken with the aid of a manometer so that pressure conditions may be carefully noted as they exist. Finally, the study of the spinal fluid for its various pathological characteristics should be made by competent observers.

The use of an opaque substance, such as lipiodol, in the spinal canal was recently tried. In one case, an old fracture dislocation of the spine, there developed such intense signs of root irritation following injection that this procedure has been regarded as very limited in its application.

JUDD, E. STARR, AND POLLOCK, LEE W. Diverticulitis of the colon. *Ann. Surg., Phila.*, September, 1924, lxxx, 425–438.

Diverticulitis is a disease of middle and old age. It is more common than was formerly believed, mainly because of routine roentgen examinations now conducted. In the Mayo Clinic during the last year, one-third of the positive roentgen-ray examinations of the colon disclosed diverticulitis or diverticulosis. The condition is apparently not progressive and may remain unchanged for years. In many instances it does not produce any apparent symptoms.

The roentgen-ray reveals two types of diverticula: Those associated with spasm, inflammatory thickening of the intestinal wall and partial obstruction seen most often in the sigmoid and called diverticulitis; and second, those distributed in various parts of the colon without spasm, thickening or narrowing, and called diverticulosis. When diverticula are filled with barium they are seen as rounded or oval shadows projecting through the intestinal lumen. Such shadows in conjunction with spasm or organic narrowing of the bowel are pathognomonic of diverticulitis. The differential diagnosis is chiefly concerned with carcinoma, phlebolith, calcified glands, urinary calculi and barium pent up in contracted haustra.

Diverticula may fail to fill with barium if they contain fecal matter or have a stenotic inlet, and in such event diverticulitis may resemble carcinoma. Carcinomatous diverticulitis, if extraluminal shadows are present, cannot be distinguished from benign diverticulitis. By manipulation during the screen examination shadows of the concretions mentioned may be shown to have no relation to the bowel. Normal barium-filled haustra are not accompanied by a filling defect and tend to disappear or to change their situation. Diverticular shadows maintain a fixed position and may persist after the bowel is emptied.

Many patients with diverticulitis can be relieved by dietary and medical management. If an abscess forms from the perforation of a diverticulum or an extension of the infection through the wall of the colon drainage is indicated. If perforation occurs into other regions an operation is the only procedure offering relief. Brief reports are recorded of 12 typical cases.

DECOURCY, JOSEPH L. Cancer of the thyroid. *Ann. Surg., Phila.*, October, 1924, lxxx, 551–554.

Experience has shown that cancer of the thyroid is rarely primary but that it develops in practically every case of adenoma of long duration. Of 3640 cases examined, there were 1242 thyroidectomies for all types of goiter between 1919 and 1923. Of these 16 were truly cancer and 8 more were doubtful. That is, there was 1.3 per cent of undoubted cancerous change and 0.7 per cent additional in which cancerous change was probable. Thus, cancer, apparently, is not very frequent yet a thorough microscopic examination of each specimen removed shows a frequency of carcinoma that cannot be neglected.

All adenomata should be removed as soon as diagnosed; surgery offers 100 per cent cure in adenoma of the thyroid with a mortality of less than 1 per cent. Roentgen and radium treatment have no place in the treatment of adenoma and are more apt to do harm than good. When cancer has advanced to the stage where clinical diagnosis is possible then the method of treatment becomes problematical. Apparently surgery is not indicated in such cases. Needling with radium at present offers the best means at our disposal. Deep roentgen therapy may find its place in the treatment of thyroid cancer, but there is the danger that it may do damage to the parathyroid bodies.

The technique for needling with radium is to open the wound and separate the muscles as in the first step of a thyroidectomy. The needles are then inserted into one lobe of the mass, each needle about one-half inch distant from the other. The wound is left open and the needles removed in twelve hours. The following morning, twelve hours later, the wound is closed and the patient is kept under observation for four weeks. Usually after two

or three weeks the mass becomes edematous and there is some danger of strangulation. The other lobe is needled in a similar manner after about the fourth week. This treatment should be followed by prolonged course of roentgen therapy.

ROENTGEN AND RADIUM THERAPY

GÁL, FELIX. The roentgen treatment of certain female diseases. *Strablentberapie*, 1924, xvii, 310–326.

The conditions discussed are pruritus vulvae, osteomalacia and condyloma acuminata.

Pruritus is a relatively harmless condition but may produce such intense inconvenience as to cause suicidal intentions in the patient. A report is given on 48 cases that have been treated since 1914 with roentgen radiation after other remedies had failed. The radiation at first was unfiltered, 2.5 ma., 25 cm. skin focal distance, 50 to 60 F units being applied at several points in the area between the vulva and the anal opening. Some cases received 2 ma., 80 to 90 F units, through 1 mm. Al. In recent years use has been made of hard rays, 2 ma., through 3 mm. Al, yielding 200 F. Good results have also been obtained with zinc-filtered radiation. When necessary the treatments are repeated every two to three weeks with tubes of varying hardness. In some cases successful result was obtained after one to two radiations. Others required five to six treatments but occasional cases have received no permanent relief, and must return after periods of several months for treatment.

The results in general show that those cases of a nervous origin, i.e., essential pruritus, cannot always be relieved by roentgen treatment; on the other hand, pruritus due to local causes such as inflammation, etc., responds readily and usually permanently. Of 6 cases associated with inflammation and eczema 4 were reexamined and all found cured. Of 9 cases associated with senile atrophy, 6 were cured and 3 temporarily improved. Of 4 cases of kraurosis vulvae 2 were reexamined, one was cured and one remained unaffected by the treatment. Of 2 cases associated with diabetes none showed improvement. Three cases with acute neurasthenia also showed no improvement. Of 19 cases of essential pruritus 11 were reexamined, 5 were cured, 4 were temporarily improved and 2 remained unimproved.

The treatment of osteomalacia properly includes dietetic management. However this alone is insufficient, especially in advanced cases. Oophorectomy has been recommended as a form of treatment and experience with 6 cases thus handled was not very good since only 2 could be reported as having completely recovered after this treatment. Administration of roentgen rays was tried in 4 cases with very good results. The radiation was applied in small doses filtered through 3 mm. Al at a focal distance of 20 cm.; 200 Fürstenau units were applied to the skin over each ovary. Roentgen castration was performed to 2 such cases with a successful recovery after three or four applications. In a third case the woman was past menopause and the radiation was cautiously applied to the thyroid. After five treatments she was discharged and has remained in good health for at least two years. In a fourth case the woman was seven years past menopause, but the radiation was applied to the ovaries and after four treatments there was a pronounced improvement, the pains having ceased and ability to walk having returned.

It appears therefore that the roentgen treatment of osteomalacia (one case approaching senile osteomalacia) is able to yield successful results in so far as the symptoms are removed; and it is interesting to note that irradiation of the thyroid is able to produce an affect.

Condyloma acuminata, occurring with gonorrhea can be very definitely treated by roentgen radiation in a painless manner. It is true that simpler methods can be used for treatment of this condition but in such cases where powdering is impossible roentgen therapy has certain advantages over the curette, caustic, etc. Six such cases have been treated, 5 in conjunction with gonorrhea; 200 Fürstenau units were applied through 3 mm. Al at one time over the whole affected region, and where it appeared necessary the procedure was repeated every three weeks. In most cases the process receded after the first two or three weeks and then completely disappeared. Most of the cures were produced after four treatments. A disadvantage of the treatment lies in the fact that its effect does not appear at once.

HEIMANN, FRITZ. The roentgen and conservative treatment of benign disease of female sex organs. *Strablentberapie*, 1924, xvii, 290–309.

The management of cases is discussed from the standpoint of the general practitioner rather than the specialist. The treatment of simple uncomplicated myomas and of chronic inflammations is discussed in detail. Malignancies, complicated myomas and acute infections are left out of the discussion.

Among the various means for conservative treatment of the uncomplicated myoma and accompanying hemorrhages the roentgen ray is of great utility. The indication for irradiation must be carefully determined. Not every myoma can be irradiated. Only the uncomplicated one can be thus treated, hence the need for reliable diagnosis. There are also contraindications which make it more desirable to operate than to irradiate. Amenorrhea was successfully attained in hundreds of cases without difficulty after considering the indications favoring irradiation. It is advisable to administer this treatment mainly to women approaching the menopause. However, there seems to be ample ground for believing that younger women can also be thus treated without permanent injury to their ability to procreate. Although irradiation stops hemorrhage definitely this is not always the case with the accompanying pain. Shrinking of the tumor takes place very slowly and in certain cases after many years one is still able to see only slight change in the size of the myoma. Consequently correct selection of the cases is a *sine qua non*. The technique of irradiation of myomas is simple and modern apparatus is hardly necessary to accomplish the required end. (The technique of administration is not given.)

One of the most important branches of treatment of the conditions discussed comes under the term balneology, for the devices employed greatly aid an intensive treatment of the conditions. The hydrotherapy stimulates an improved metabolism, nutrition, regulation of intestinal activity and genital rest. In addition, favorable psychic elements are involved which make the treatment extraordinarily effective. It is pointed out that intelligent cooperation of the patient is an important factor in treatment. The patient should be trained to be careful and dependable since an indolent attitude is a great barrier to recovery.

Reinking, F., and Peter, G. Therapy of laryngeal papilloma. *Strahlentherapie*, 1924, 401–403.

The difficulties of the surgical treatment of this condition are well known. An unsuccessful attempt was made to treat 3 cases with roentgen rays applying an erythema dose from a distance of 40–50 cm. through 3 mm. Al every four weeks.

Deep roentgen therapy was tried in 2 cases (which are briefly described) with satisfactory results. The dose applied was one-half skin unit dose filtered through 0.5 mm. Zn. This was given by cross fire to the larynx through lead glass tubes. The second case required a second roentgen treatment two months later.

MISCELLANEOUS

Altmann, V. The direct measurement of true scattered rays inside and out of the ray pyramid. *Strahlentherapie*, 1924, xvii, 341–350.

The general form of the curve of the intensity of scattered radiation with increasing depth in the direction of the central ray was found to be the same as that reported by Borell. From the central ray toward the periphery of the pyramid of roentgen rays there was found to occur a gradual decrease in the intensities of the scattered rays. Study of the quantities of scattered rays outside the direct roentgen-ray pyramid disclosed first a sudden decrease, and farther out the decline was again gradual. The quantities of scattered rays outside of the roentgen-ray pyramid were found to be of such magnitude that they ought not to be neglected in practice.

By placing the screen directly upon the surface of the body to be irradiated, the amount of scattered radiation is relatively slight at the surface around the direct portal or entry. Indeed, this form of field delimitation is more advantageous in practice than the placing of screens near the tube because it provides better protection for the skin.

David, O., and Gabriel, G. Capillary microscope studies on the deep action of roentgen rays. *Strahlentherapie*, 1924, xvii, 192–196.

The radiation was delivered by a neointensive apparatus, A E G Coolidge tube at 220 kv., 3 ma., 0.5 mm. Cu plus 1 mm. Al (skin unit dose equals 16 minutes), 23 cm. skin focal distance with 5 cm. of water interposed. The dosage was carefully determined qualitatively and quantitatively; and applied to a finger or an arm so that the depth effect could be studied on the distal skin surface. Observations were made in 5 different cases, and the capillary microscope showed alterations that did not differ essentially from those observed and previously reported in detail on the effect of radiation upon the surface.

The characteristic response was dilatation of the vessels. This again indicates that the most important cause of this change is of nervous nature. It seems probable that the roentgen rays exert their effect upon the locality which regulates the expansion or contraction of the vessels. Since our present knowledge indicates that capillary response is an independent reflex mechanism, we see in this again a proof of the fact that the point of attack lies in the contractile elements of the capillary wall.

DONATO, J. y V. G. A new scattering medium in the administration of deep roentgen therapy. *Strablentherapie*, 1924, xvii, 351–361.

In order to apply an adequate depth dose when employing large portals and long focal distance it is necessary that there be a uniform volume exposed. In the case of the human body, this is obviously impossible except with the aid of filling materials such as wax, plaster, etc. The wide variety of materials suggested for this purpose has been examined and discarded because of certain inherent defects in each. It was discovered that ordinary rice fulfills the office of a filling material very satisfactorily. Although each rice grain has a higher specific gravity than water, yet a mass of rice contains enough air spaces to bring the average density to that of water or of the human body. The writer therefore builds a box around the part of the body to be irradiated and fills it with rice grains. This procedure has the advantage of being of least inconvenience to the patient and operator. The treatment of several cases is described to illustrate the use of this scattering material.

FORNERO, AND BALLI. Reciprocal interglandular relations of the roentgen irradiated uterine hormonal tissue. Experiments on the clinical application in constitutional amenorrhea. *Strablentherapie*, 1924, xvii, 366–380.

After a series of irradiations of the uterine area using stimulating doses, return of menstruation was observed in certain cases of constitutional amenorrhea. In some the menstruation remained for more than a year after irradiation. In constitutional amenorrheas, as well as in certain other inexplicable menstrual dysfunctions, it appears that there exists an inadequacy or perhaps a sluggishness of the endocrine utero-ovarian function. A great number of observations have demonstrated the interdependence of function of the uterus and the ovaries. As a result of clinical observations it may be stated that the administration of roentgen rays in certain doses overcomes utero-ovarian sluggishness and inadequacy either through a direct stimulation upon the genital endocrine area or by exerting this stimulation through extra-genital endocrine systems. The latter through their well-known interrelations with the sexual glands affect their function and appear to be indispensable to them.

These theories as to the clinical effect of roentgen rays are supported by experiments made upon rabbits. The animals were exposed to roentgen rays and after certain intervals the uterus was removed and examined by serial section. In this manner the functional activity of the interstitial tissue of the uterus was followed.

HEIDENHAIN, L. Generalized conditions for hypotheses concerning roentgen therapy. *Strablentherapie*, 1924, xvii, 112–133.

A critical discussion is given of the heat point theory of Dessauer, and it is urged that in the present scanty state of our knowledge such a hypothesis really adds nothing, since the definition is given in terms of vaguely known facts. The only value of the matter lies in the discussion that it arouses.

The present need is for additional fundamental observations, carefully accumulated to furnish an adequate basis for a completely explanatory hypothesis. One subject that has been rather neglected is adequate information upon the effect of radiation in relation to the blood volume exposed in healthy individuals. There are, of course, numerous observations upon individuals with various diseases. The question, however, is what happens to the metabolism and the blood constitution when a small volume is irradiated, as for instance in the ankle, and a large volume of blood as for instance in the thorax. We are accustomed to the application of rather large doses, and it should be remembered that even small doses such as 10 to 20 per cent skin unit dose can produce a definite effect upon the body if carefully looked for.

HINTZE, ARTHUR. The effect of roentgen rays on the cartilage of adults, and indications for operation and irradiation. *Strablentherapie*, 1924, xvii, 175–188.

Ten cases are illustrated (but not described in detail) demonstrating the effects of roentgen irradiation upon the cartilage of the nose, ear, larynx and ribs. In the roentgen treatment of chancroid of the nose and ear, the underlying cartilage of course receives a portion of the radiation. When the lesion is superficial and has not invaded the cartilage the usual doses of radiation produce no apparent injury to the cartilage. When, however, the cartilage itself presents a raw surface and is involved in the ulceration, epithelialization does not take place and the ulcer persists despite further irradiation. Such a condition is a clear case for operative removal of the chancroid together with the involved cartilage. The surrounding tissues which have undergone irradiation also show no difficulty in healing promptly.

The cartilage of the larynx in the case of advanced laryngeal carcinoma is usually also involved, and there seems to be no prospect of irradiating the carcinoma and preserving

the cartilage. However, in the early stage of the carcinoma a proper dosage of radiation can control the malignancy and yet apparently leave the cartilage intact. In all such cases, however, the danger of stenosis of the larynx is imminent, and it is perhaps advisable to perform a prophylactic tracheotomy and introduce a tracheal cannula of celluloid which gives minimal interference to roentgen treatments.

The costal cartilages naturally receive radiation during the treatment of mammary carcinoma. When the cartilage is uninvaded by the carcinoma, it seems to be able to withstand relatively severe doses of roentgen radiation, and granulation follows apparently in a normal fashion. It is in those cases in which tissue injury is such as to permit only very inadequate granulation that damage to the cartilage has to be reckoned with.

Regarding the cartilage of the large joints of the extremities, especially those lying very close to the surface, as in the knee, usual technique of roentgen treatment does not seem to cause any immediate clinical injuries.

Experiments on dogs and rabbits show essentially the same facts. If these animals are given the epilation dose for their species or even a dose causing a first degree burn, the healthy cartilage of the adult animal does not show the least injury macroscopically or microscopically for at least several weeks following treatment. These effects were observed not only in the cartilages of the ear, nose and larynx but also in the sternum, ribs and large joints.

HOLTERMANN, CARL. On the effect of roentgen and radium rays upon vital staining. *Strablentberapie*, 1924, xvii, 362–365.

In this discussion it is pointed out that irradiation with radium produces much less of a general effect upon the organism than is the case with roentgen rays. Vital staining experiments with trypan blue, lithion-carmine and indigo-carmine showed no striking changes after radium irradiation. On the other hand, previous observations had shown rather marked response after roentgen irradiation. However, when equivalent fatal doses of these rays were administered the effect of the radium upon vital staining was considerably stronger.

Considering all the aspects, it seems rather certain that the general effect of roentgen rays is much greater than the general effect of radium. An explanation of the cause of the general effect is still wanting. It appears that it is probably due to some blood changes. These changes may be in the blood cells and probably also in the plasma; and may consist of protein, carbohydrate, bilirubin, lipoid shifts, alterations in H-ion concentration, in CO_2 binding, in clotting power, in cell sedimentation, in antibody formation, and perhaps also in photoactivity.

HOLTERMAN, CARL. Vital tissue staining under the influence of roentgen rays. *Strablentherapie*, 1924, xvii, 158–174.

The results reported are based upon experiments on over 100 white mice. The animals were of uniform age and treated as uniformly as possible in order that good comparative data might be obtained. The vital stains used were trypan blue, lithion-carmine and indigo-carmine, only the first of these dyes gave the most uniform results. The dye solution was usually injected subcutaneously in the back of an animal, and the radiation was administered for 10 minutes, skin focal distance 23 cm., 62 kv., 2 ma., from a Coolidge tube, without filter. This dose caused death in uninjected animals in eight to twelve days and in injected animals in six to ten days.

The object of the experimentation was to determine whether administration of roentgen rays affected the accumulation of vital dyes in the tissues, especially the kidneys. There was found in the kidneys a general increase in staining and in stain excretion, in the dye accumulation within the glomeruli, and also in the follicles of the spleen as a result of roentgen irradiation. This confirms the observations of Schmidt and Halberstädter. This increase could be simulated by double staining (lithion-carmine and trypan blue). Apparently the effect is due to an increased dye concentration in the blood preceded by a blocking of the cellular accumulating mechanism by lithion-carmine.

This functional elimination of the accumulating cells by maximum loading up with lithion-carmine is not corrected by roentgen irradiation. Thus the radiation is unable to function as a stimulant in the direction of increased cell accumulation. A cell not completely loaded up is not blocked in further action by roentgen irradiation.

The effect of roentgen radiation on vital staining with trypan blue can hardly be a direct one since it may be produced by irradiation of other portions of the body. It appears rather that some change produced in the blood and perhaps also a direct or indirect participation of the vegetative nervous system causes the characteristic picture found in vitally stained, roentgen irradiated animals. The results obtained with trypan blue after roentgen irradiation may or may not occur with other vital stains. Many of the differences are apparently due to the specific nature of

the dye. Thus lithion-carmine is not accumulated in the glomerulus of the kidney either before or after irradiation; and on the other hand, trypan blue and lithion-carmine both appear in the spleen follicles after irradiation. The characteristic picture found after roentgen irradiation of the kidney is not affected by sex although the gravid period in the female may produce some modifications. In gravid animals the changes are difficult if not impossible to demonstrate and it may be that vital staining of the kidney in irradiated gravid animals obeys other laws. The placenta and ovarian membranes remain impermeable to the vital dyes used even after roentgen irradiation so that the amniotic fluid and the fetus did not take vital stains during life.

HOLTHUSEN, HERMANN. The relations between physical and biological dosimetry. *Strahlentherapie*, 1924, xvii, 49–68.

The problem resolves itself to selecting from among the various energy transformations occurring in the absorption of roentgen rays those particular ones that appear to be the basis of the roentgen action. These may be either the active agent in the biological reaction or, at least so far as they depend upon wave length, others that obey the same laws. Only when these requirements are satisfied in full, will there be any hope for accomplishing absolute dosimetry.

Theoretical consideration of the various energy transformations occurring in the absorption of roentgen rays in gases and in biological material leads to the conclusion that absolute dosimetry is not possible under present conditions of knowledge. Ionization and biological reaction are related phenomena in the fundamental physical mechanism of roentgen action but they are not altogether identical, hence the meager prospect of utilizing the ionization method for absolute dosimetry. It is evident, therefore, that a biological dosing is not attained in comparative dosage from rays of different composition.

The transfer of results obtained upon one biological object to another is permissible since the quality of the roentgen action, at least in the range of roentgen rays, show no appreciable dependence upon the wave length. This is another way of expressing the fact that the various partial reactions constituting the biological reaction as a whole are equally dependent upon the quality of the roentgen rays. Independence of the biological reaction from the wave length is a necessary basis of biological dosage. Therefore, in principle all biological objects are of equal value and the selection of a particular one for purposes of standardization depends mainly upon adaptability to the experimental conditions. A special requirement for such a test object is that it shall have such dimensions that alterations in intensity caused by absorption within the test object shall be negligible.

Of the various biological materials suggested as test object, the ascaris egg method of the author appears to be most suitable because the results depend to a minimum upon individual variation. As is well known, this method involves the exposure of a large number of ascaris ova to radiation, and observation is made upon the number of eggs in which development has been stopped. It is pointed out that this method has several disadvantages. The various lots of the ova have different degrees of sensitiveness to the radiation, and it is therefore necessary to standardize each lot. Thus, the ascaris egg method is merely limited to the measurement of comparative doses. Moreover, these ova may not be easily available except in places where horse ascarides can be obtained. This biological method of measurement should be used in conjunction with the ionization method of standardization and is not intended as a substitute for it. The method may also be used for a comparison of skin unit doses in various institutes.

KAWASHIMA. The effect of radiant energy upon the circulation in the isolated frog's heart. *Strahlentherapie*, 1924, xvii, 381–389.

The heart was removed to a Straub chamber and connected by levers to produce a kymograph record and into the chamber was led oxygen containing radiothorium emanation. Careful observation in 16 such experiments disclosed no effect of the alpha, beta or gamma rays upon the heart beat as compared with controls.

Similar experiments using radiant energy from a special carbon arc lamp showed that, on the average, a pronounced inhibition of the heart was produced after an exposure of one-half hour. This period was considerably shortened when eosin was used as a light sensitizing agent.

KOK, FRIEDRICH. Observations on the effects of roentgen irradiation upon normal and carcinomatous mice. *Strahlentherapie*, 1924, xvii, 327–330.

It is already well known that roentgen rays in some way render the toxins of carcinoma harmless to a certain extent, and it has now been discovered that there is apparently a reverse effect, that is, the toxic effects of roentgen rays are neutralized to some extent by carcinoma.

When normal mice receive 50*e* (measured on the Friedrich iontoquantimeter) they succumb in 5.5 days, and with 25*e* in 11.7 days, apparently from an intoxication. Similar mice with carcinoma when irradiated live 11.1 days after 50*e*, and 24.0 days after 25*e*. Normal mice injured by roentgen irradiation, if subsequently inoculated with carcinoma, are relieved of the injurious effects of the irradiation as if the toxins produced by irradiation were neutralized by the carcinoma cells introduced. Individual cases may show wide variations but in general the above observations hold true.

KOK, FR. Biological experiments on the effect of irradiation upon carcinoma. III. *Strahlentherapie*, 1924, xvii, 134–157.

The present work confirms and extends previous observations made upon transplantable carcinoma of the mouse. The work may be summarized in the following statements: With suitable roentgen technique irradiations of mice shortly after inoculation with carcinoma result in a growth-retarding effect upon the inoculated tumor cells. In a like manner timely irradiation of carcinoma locally also produced a favorable effect. In this case irradiation through a large portal was more effective than one through a small portal.

The most favorable dose in these local treatments was found to be somewhat less than the mouse epilation dose (225*e*). Doses down to 100*e* are thus effective, contrary to what is found for irradiation of the tumor itelf. Higher doses (above 300*e*) are of less or no effect at all. The strongest effects are observed after irradiation of the whole animal, especially after administration of 10 per cent of the epilation dose (25*e*). Where tumor was present, 20 per cent of the epilation dose was necessary. Early irradiation of the whole animal with these light doses even though the tumor site was screened out resulted in almost equally pronounced response.

In the timely irradiation of the mice the general effect (the support of defence powers of the organism) plays the most important rôle in combatting and destroying carcinoma cells.

KLEESATTEL, HANS. The roentgen sensitiveness of actinomycetes. *Strahlentherapie*, 1924, xvii, 390–392.

Jüngling has indicated that the roentgen therapy of actinomycosis (at least in the head and neck) is the method of choice. It was therefore interesting to determine where the causative organism is sensitive to roentgen radiation. Several experiments were made upon *Actinomyces boris*. It was found that doses of 10 skin units and less caused no apparent killing off of the organisms in pure culture and influenced slightly, if at all, the multiplying power of subsequent generations.

In view of this apparent absence of response of the actinomycetes to roentgen rays it would seem that the pronounced therapeutic effect of the rays in the disease caused by these organisms must come from a response by the infected tissues to the radiation.

LUDEWIG, P., AND LORENSEN, E. Studies on the content of radium emanation in the air of the Schneeberger mines. *Strahlentherapie*, 1924, xvi, 428–435.

There appears to be an unusual incidence of carcinoma of the lungs amongst the miners of Schneeberg, Saxony. This suggested an examination of the mine air and it was found that it contained radium emanation in relatively considerable quantities, the order of magnitude being about 10 Mache units per liter. An examination of the rocks showed a low content of radium, not very much greater than that found in ordinary granite. The emanation content was very high in the unventilated portions of the mines.

The possibility that carcinoma of the lungs may be due to the presence of emanation seems fairly strong, and experiments are planned to test this point.

VON LIEBENSTEIN. Roentgen irradiation of the whole human body as based on the conception of a space dose. *Strahlentherapie*, 1924, xvii, 331–340.

Experimental studies have shown that irradiation of the whole animal can prove beneficial even though the tumor is screened off. Such a procedure may prove desirable in the treatment of human cases. In that event it becomes necessary to determine what is the safe dose. A description is given of a method whereby the necessary factors are determined empirically.

Space dose is defined as "the product of the mean roentgen energy penetrating the irradiated body times the volume of the body in cubic centimeters." This factor can be calculated after (1) a determination of the distribution of roentgen energy in the large field; (2) the determination of the magnitude of the body irradiated and its distribution in the field; and (3) determining the mean radiation intensity within the body. The distribution of roentgen energy is readily determined by means of the iontoquantimeter and similar measuring devices. The volume of the body is determined by water displacement in a bath tub and the

distribution of volume over the body by calculations based upon measurements on the individual. The mean intensity of radiation has to be determined for each section of the body. The data obtained in the case of one individual are charted and tabulated. This woman weighed 58 kg. and was 160 cm. high. It was calculated that using a Coolidge tube with tungsten anticathode, 180 kv., 2.5 ma., applied through 0.5 mm. Zn plus 0.65 mm. Cu at a distance of 100 cm. to the skin of the patient with a field of 167 cm. this person could receive safely 49 to 62 ɛ, measured at the central ray upon the skin, in 48 hours.

Experience will show whether such a calculation can yield useful data for therapy.

PETER, GUSTAV. Glaucoma following roentgen treatment. *Strablentherapie*, 1924, xvii, 189–191.

A man, aged sixty-four, received roentgen treatment for carcinoma of the cornea and conjunctiva bulbi in an attempt to avoid enucleation. The roentgen treatment (1½ skin unit dose) was repeated a total of five times in five months because of persistent recurrence. Following the last treatment recurrences seemed to have been eliminated, but the patient began to complain of conjunctival pain and photophobia in the affected eye.

The lacrymal caruncle had to be included in the field of radiation and the approaches to the lacrymal canal became permanently obliterated, thus preventing lubrication of the eyelids. One year after the last treatment the affected eye developed glaucoma and had to be enucleated.

Microscopic examination of the eye disclosed a striking sclerosis of the corpus ciliare. The normally delicate fibrillary connective tissue was replaced by coarse fibrous collagenous tissue poor in cells and containing finely granular spots of lime deposits.

This experience shows that great caution must be exercised when it is necessary to make repeated exposures of the eye to roentgen rays.

VON SALIS, H. Alterations following roentgen irradiation of the submaxillary gland. *Strablentherapie*, 1924, xvii, 395–400.

Regressive changes are produced in practically all of the cell types of the submaxillary gland as a result of roentgen irradiation. The changes are evidenced mainly in a general loosening and disorder in the lobules resulting in a flaky nodose distribution of the degenerated cysts. The serous portion of the glandular tissue is especially attacked and takes the form of vacuolar degeneration, drop formation and extensive mucoid degeneration, cell and nuclear shrinkage and also karyorrhexis. There is also a certain amount of inflammatory edema. The efferent tubules are practically unaltered and the blood vessels, except for a certain plethora show nothing unusual microscopically. The whole picture is that of a degenerative atrophy of the specific tissue elements only, and there is no sign of replacement by scar tissue. This means that the injury produced is not permanent.

These observations were made upon glands removed from 3 different cases as well as in experiments upon dogs. In dogs the injury to the submaxillary glands appears much more rapidly than that in the parotid, and regeneration appears first in the submaxillary. The dose necessary to produce considerable injury in the submaxillary is very much greater than that necessary to produce a similar effect in the ordinary lymph glands is less than that of the salivary glands. The salivary glands of the dog are incomparably more resistant to the effects of radiation than those of man.

The effect of radiation upon the submaxillary glands is more in the nature of a disturbance of function than disturbance of growth of the cells. Clinically, the temporary injury to the submaxillary by roentgen rays in the presence of intact parotid and sublinguals does not influence salivary secretion. It therefore becomes clear why a lasting atrophy of the salivary glands cannot be produced by roentgen irradiation. An effective reduction of salivation can only be produced by a bilateral ligation of the ductus tenonianus and extirpation of the submaxillary glands. The sublingual glands will suffice then to maintain the necessary moistness of the mouth.

SEEMANN, H. The quality of roentgen rays and their spectrographic measurement in therapy and roentgenology. *Strablentherapie*, 1924, xvii, 69–112.

A detailed discussion is given of the principles involved in the measurement of wave lengths of roentgen rays and a description is given of the set-up of the Seemann spectrograph and its applications to qualitative and quantitative spectrometry.

Comparative spectrometry of radiation output from different machines has disclosed that the differences in dose quotient curves as obtained with quantimeters upon the phantom uniform filtration and apparently uniform voltage are due to the often appreciable differences in intensity distribution in the spectrum. Knowledge of the minimum wave length alone does not suffice in the operation of the roentgen tube with the pulsating current, from tabulated or charted dose quotients.

Differences in relative quantity in the roentgen spectrum obtained cannot apparently be easily corrected for, so as to be introduced with the other factors of tube operation. Only the spectrum of a uniform voltage machine is precisely defined by the minimal wave length and includes the intensity distribution so that this value may be used without correction as a factor of ray hardness in present-day tables. The difficulty, however, lies in the fact that the voltage values recorded in these tables may be as much as 10 to 30 per cent off and this is by no means the only source of error. Normal tables generally applicable to deep dosage can be constructed only from the use of uniform voltage apparatus spectrographs and such quantimeters as possess the same qualitative absorption as the biological object. So long as this latter condition remains unfulfilled the tables can serve only for predominantly homogeneous rays within a wave length interval of one octave. The present problem of spectrometry is the preparation of exact normal tables to serve as aids in scientifically correct measurements.

It is pointed out that the objection raised by Küstner that spectrograms may yield voltage readings as much as 23 per cent in error can be accounted for by the following fact: Küstner made use of an intensifying screen in photographing his spectrograms; but it is pointed out that such screens have a threshold value and prevent the recording of lower intensities. If such spectrograms are exposed for a longer time and without the use of an intensifying screen the value obtained for operating voltage is precise.

VOGT, E. Gynecological roentgen carcinoma. *Strahlentherapie*, 1924, xvii, 231–289.

The fact that in recent years there have appeared malignancies of the uterus or ovaries in women who had received roentgen treatment to produce amenorrhea has aroused apprehension and caused some to question if the general practice of roentgen treatment of benign gynecological conditions might not be a harmful procedure. It was therefore worth while to inquire into such authentic cases as were available and determine precisely how far the roentgen treatment *per se* could be blamed for the origination of the malignancy following treatment.

In the term gynecological roentgen carcinoma is included all those malignant carcinomas of the skin as well as those of the external and internal sex organs in so far as definite connection can be established with a preceding deep or superficial roentgen irradiation. With this in mind a total of 28 cases was carefully studied. These included carcinoma of the vulva, carcinoma of the skin of the abdomen, primary and secondary carcinoma of the ovaries, collum and corpus carcinoma of the uterus and bilateral mammary carcinoma. Only 3 cases appeared to be genuine roentgen carcinomas and 2 of the 3 were not entirely free from possible contributory causes. Only the case of bilateral mammary carcinoma reported by Depenthal-Frangenheim appears to satisfy all the requirements of a genuine gynecological roentgen carcinoma.

In all other cases, especially in the carcinomas of the ovary and uterus a critical examination of all the circumstances gave no definite grounds for the view that roentgen rays were in any way responsible, directly or indirectly, for the origination of the tumors. It therefore appears that present indications for the roentgen irradiation of myomas and benign hemorrhages of the uterus still retain their firm foundation. The clinic of malignant ovarian tumors and uterus carcinoma following roentgen castration presents no peculiarities. The histological picture of the tumor is exactly the same as that of non-irradiated carcinomas.

To prevent possibility of the occurrence of a uterus carcinoma after a roentgen castration, the precaution should be taken to secure a diagnostic curettage before irradiation. The patient should be made aware of the rare possibility of the disturbance in the menopause. Hemorrhages during menopause after roentgen castration are highly suspicious of carcinoma of the uterus.

Experience from experimental cancer research and the observations in gynecological roentgen carcinoma point with great emphasis to the significance of the endogenous stimulation or irritation in the origination of the tumors.

SIMONS, ALBERT. The practical significance of so-called "fore-irradiation" as a source of error in the exact dosage of roentgen rays. *Strahlentherapie*, 1924, xvii, 436–438.

In the operation of vacuum tubes it is necessary to begin with a low voltage in order to protect the instrument and then to push the voltage to the required capacity. This early period (lasting about 1.5 minutes) is termed "fore-irradiation." During this period the output of soft rays is considerable even after filtration. Experiments were made, and measurements show that filtration through the equivalent of 10 mm. Al is adequate for protection. Experiments made upon a test subject also showed that with the filtration usual in deep therapy there is, for practical purposes, no danger of injuring the skin by soft radiation during the "fore-period."

TSUKAMOTO, RYOTARO. Disturbances of metabolism following roentgen irradiation of the liver. *Strablentherapie*, 1924, xviii, 320–368.

It is known that so-called roentgen cachexia may appear following the irradiation of any portion of the body. Regardless of the site of irradiation, certain general effects appear which can only be due to alterations in the general metabolism. In order to throw some light upon the processes occurring, a preliminary study of the blood chemistry in rabbits was made following irradiation of the liver region. In general the radiation consisted of one skin unit dose applied upon the skin over the liver, while the rest of the animal was carefully screened off. The rays were filtered through 0.5 mm. Zn or 0.5 mm. Cu plus 1 mm. Al. Chemical tests of the blood of each animal were made before and within the first twenty-four hours after irradiation, and in certain cases several days and weeks later. As a rule, the animals died fourteen days after irradiation because of the extreme dose. The detailed protocols of all the experiments are given.

The general result of the studies of the intermediary organic metabolism was as follows: The immediate acute effect of radiation is characterized by a temporary increase in the rest-nitrogen, urea, amino acids, and most strikingly of the blood sugar. The duration of the acute effect is within twenty-four hours and it occurs in the same manner in fasting animals as in those fed. Since blood sugar increase occurs in both fasting and fed animals it is evident that the effect must be in the nature of a glycogen mobilization. The increase in rest-nitrogen and in amino acids under like conditions can only be due to an increased protoplasmic destruction. Since, however, the increase in rest-nitrogen and in amino acids parallels the urea content of the blood, it must be concluded that the urea-forming function of the liver remains approximately normal despite irradiation.

Comparatively little can be learned from the present experiments as to the chronic effect of irradiation since most of the animals succumbed to the severe doses. This chronic effect is evidenced anatomically in a progressive atrophy of liver tissue with decrease in glycogen. In the present study liver atrophy was present and was paralleled by a gradual increase of the rest-nitrogen and amino acids in the blood. Since, however, the blood urea was also increased it appears that increase in protoplasmic destruction is paralleled by an increased urea production, i.e., the urea-forming function of the liver persists fairly well despite liver atrophy.

Since, however, the blood sugar continues to show no important change where the food intake is carefully regulated and since liver glycogen is observed microscopically to have a tendency to disappear, it must be concluded that the body cells in the period after irradiation consume more sugar than before. Perhaps in irradiation the nitrogen metabolism is especially disturbed in the sense of an increased nitrogen destruction and there occurs a compensating increase in combustion of sugar and perhaps also of fat. The losses in body weight of the animals support such a view.

Some blood lipoid determinations indicate that a chronic after-effect of a single irradiation is an actual increase in blood lipoid which speaks for a mobilization of the fat from the deposits. This increased level, however, drops to subnormal values except for a final renewed premortal elevation. During the period of subnormal lipoid values there occurs the greatest drop in body weight.

The results of this investigation are considered in the light of the clinical and experimental observations reported in the literature to give a consistent picture of the phenomena observed.

VOGT, E. Clinical proofs of the general effect of roentgen rays. *Strablentherapie*, 1924, xviii, 64–73.

In the behavior of myomas following roentgen castration there is to be seen evidence of the general biological effect of roentgen rays. As a result of the omnicellular effect of the roentgen rays following a castration dose there occurs along with suppression of menstruation, a cessation in growth of the myoma, which often goes on to atrophy. The hypothesis put forth to explain this action is as follows: The castration dose acts biologically upon the whole body in a stimulating sense. All the life processes are accelerated, the resistance of the body is increased and the growth of the tumor is correspondingly limited. This effect of the radiation has a variable duration which depends naturally upon such factors as dose, age and general condition of the individual. At the moment when the body returns again to a "bio-negative" phase, the latent growth energy of the tumor awakens, the tumor increases in size and the old clinical symptoms return. This explanation does not assume the existence of a malignant degeneration.

In the now extensive clinical observations upon roentgen tumors, we find a second series of proofs of the general action of the radiation. The multiple occurrence of primary roentgen carcinomas appears explicable only on such an assumption.

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